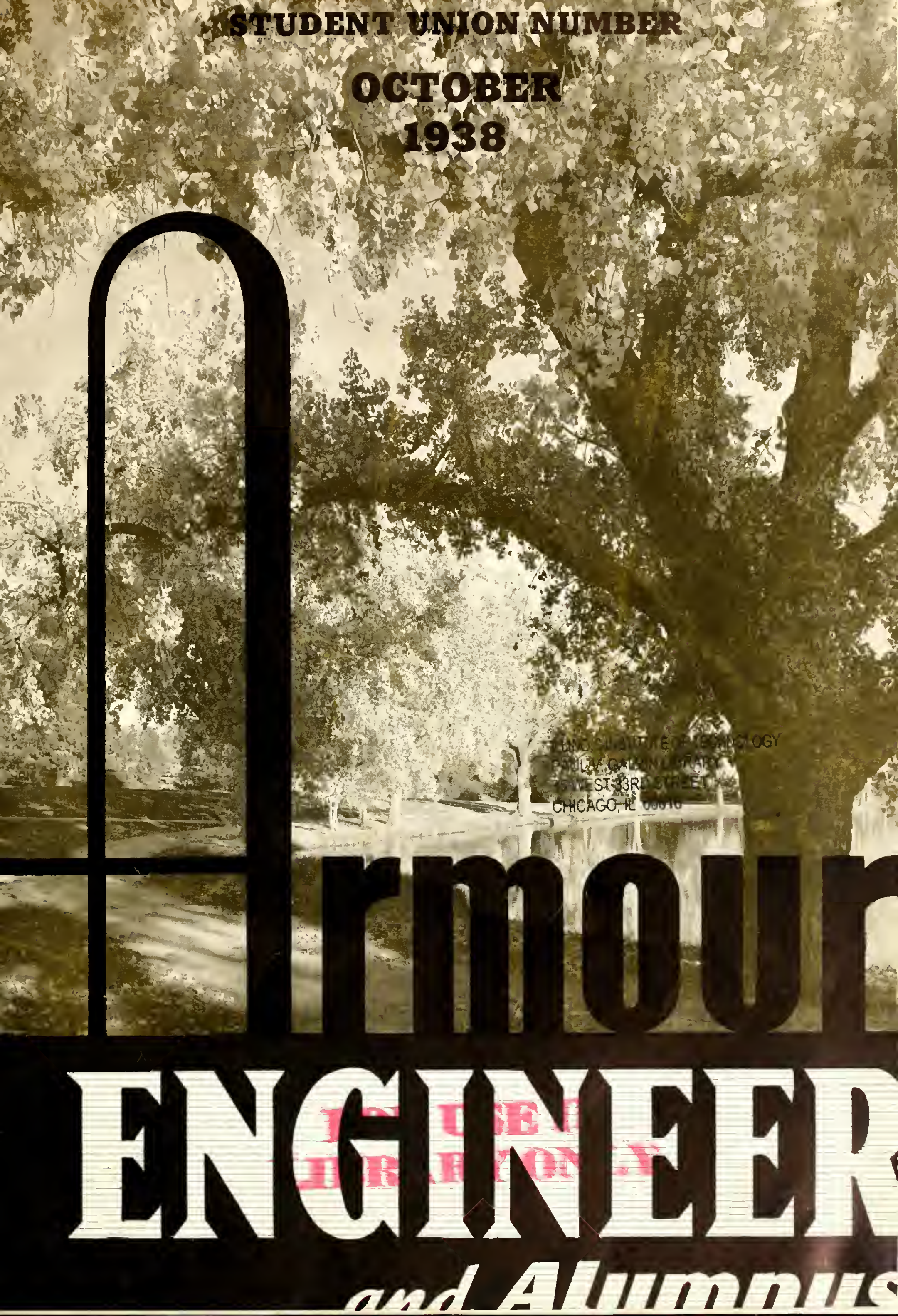

STUDENT UNION NUMBER

OCTOBER 1938

Armour ENGINEER and Alumnus

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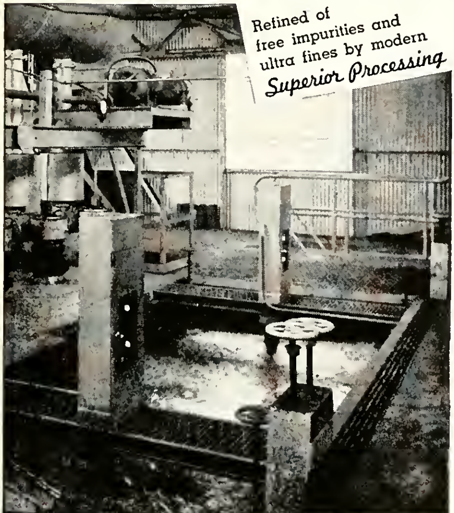

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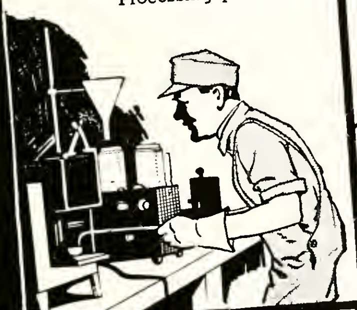

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OCTOBER 1938

VOLUME 4 NUMBER 1

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IN THIS ISSUE

THE CONTRIBUTORS

■ *Philip Harrington,* Commissioner of Subways and Traction for the City of Chicago, graduated from Armour Institute of Technology, in electrical engineering, in 1906, and went to work as a rodman for the Sanitary District of Chicago. For 29 years he continued with the engineering department, becoming chief engineer in 1933. For the past three years, until his recent appointment as Commissioner of Subways and Traction, Mr. Harrington was city traction engineer. He is also a graduate of Chicago Kent College of Law, and a member of the Bar.

■ *Richard E. Vernor,* Manager of the Fire Prevention Department of the Western Actuarial Bureau of Chicago, has made a life study of fire waste and fire prevention, specializing in the study of community fire prevention, in which field he is one of the country's outstanding experts. He is in direct charge of the activities of state fire prevention associations in nineteen middle western states, and he has been active in the work of the National Fire Waste Council, one of the agencies in a nationwide fire prevention program.

■ *Ralph G. Raymond,* graduate of Lewis Institute, class of 1926, has been Managing Director of the Chicago Lighting Institute since its opening in 1930. Known in Chicago as a lighting specialist, Mr. Raymond was instrumental in formulating the Franklin specifications used in the design of interior lighting and assisted in the compilation of a handbook for office lighting. He is active in the Illuminating Engineering Society, both local and national.

■ *John F. Galbraith,* a graduate of the University of Wisconsin, in 1928, was engaged in electrical engineering before joining the Linde Air Products Company. After several years' experience in and around Chicago, he was transferred to the General Service department, New York, where he is now engaged in development work on all phases of oxy-acetylene welding and cutting.

■ *Willis H. Carrier,* widely known for his work in air conditioning received an M. E. degree from Cornell University in 1901. He has done extensive development work in air conditioning, having developed systems for humidity control, drying, and refrigeration. Mr. Carrier has also written numerous articles on air conditioning and refrigeration and is active in the various engineering and professional societies connected with his field. He is at present chairman of the board of the Carrier Engineering Corporation and of the Carrier Corporation.

SUBWAY SYSTEM FOR CHICAGO

by

Philip Harrington

THE construction of subways for local transportation purposes has been advocated in Chicago since the beginning of the century. A number of plans have been submitted at various times by municipal agencies, and by individuals and corporations.

One of the earlier plans submitted was prepared by the city engineer, John Ericson, in 1909. The Ericson Plan provided for a system of subways in the terminal area distributing passengers from the north and south along the general line of Wabash avenue between Chicago avenue and Cermak road and distributing west side passengers over a loop subway operating from Green street on the west to State street on the east.

The Chicago Harbor and Subway Commission in 1912 prepared a plan which provided for lines radiating from the Central Business District to all parts of the city. This was an independent system of subway routes totaling 55 miles in length. It did not contemplate connections with the existing elevated rapid transit service. No steps were taken toward the carrying out of the above plans.

In 1916 the Chicago Traction and Subway Commission recommended as the initial subways to be constructed a rapid transit subway in Chicago avenue and State street from Chicago avenue and Franklin street on the north to State and 16th streets on the south, connecting with the elevated structure and to be operated by through rapid transit trains. This Commission also recommended street car subways in Washington and Jackson streets from Clinton street on the west to Michigan boulevard on the east, with a further street car connection over Michigan boulevard from Washington street on the north to 14th street on the south. The unification ordinance which would have made the building of these subways possible was submitted to a referendum held on November 5, 1918, but the ordinance was defeated.

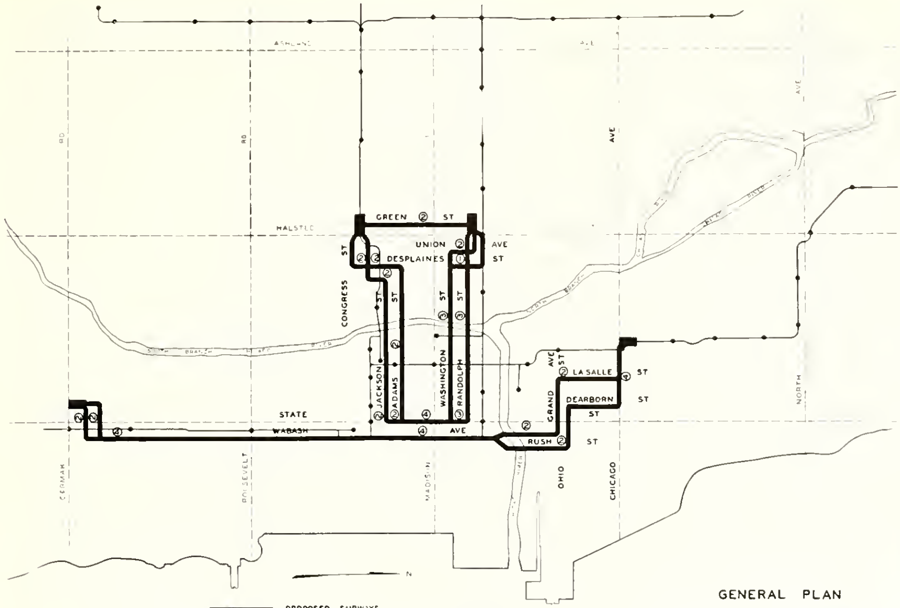
[Ed. note: Philip Harrington, a graduate of Armour Institute of Technology in the class of 1906, has been serving as traction engineer for the past three years. He was recently appointed commissioner of subways and traction by Edward J. Kelly, Mayor of Chicago, immediately after the city council had passed an ordinance creating a new city subway department.

The new department will build the initial system of subways, prepare plans for the extension of the system, and advise with the city council on all traction matters relating to the use of streets. It will also maintain the subways after they are built and supervise the use of them by the company operating them.]

The Traction Plan developed in 1923 provided for a rapid transit subway in State street connecting with the north-south rapid transit lines and a west side rapid transit subway having its principal delivery in Clark street and having a southwesterly terminus in Blue Island avenue near 14th street and a northwesterly terminus in Chicago avenue west of Halsted street. No action was taken on this plan.

The 1930 Traction Ordinance provided for a rapid transit subway in Chicago avenue and State street from Chicago avenue and Franklin street on the north to State and 18th streets on the south; and a second rapid transit subway from Milwaukee avenue and Augusta street, thence via Milwaukee avenue, Grand avenue, Dearborn street, Harrison street and Blue Island avenue to 16th street, and Blue Island avenue. A considerable amount of work was done on the plans for the State street subway, which was to be a four-track structure. The unified traction ordinance providing for these subways was approved at a special election held on July 1, 1930, but the companies were unable to carry out their reorganization plans and meet the requirements of the ordinance. After a number of extensions the ordinance lapsed on April 3, 1934.

It may be noted that with one exception all of these subway plans provided for the initial development in the terminal area. The plan of the



PROPOSED SUBWAYS

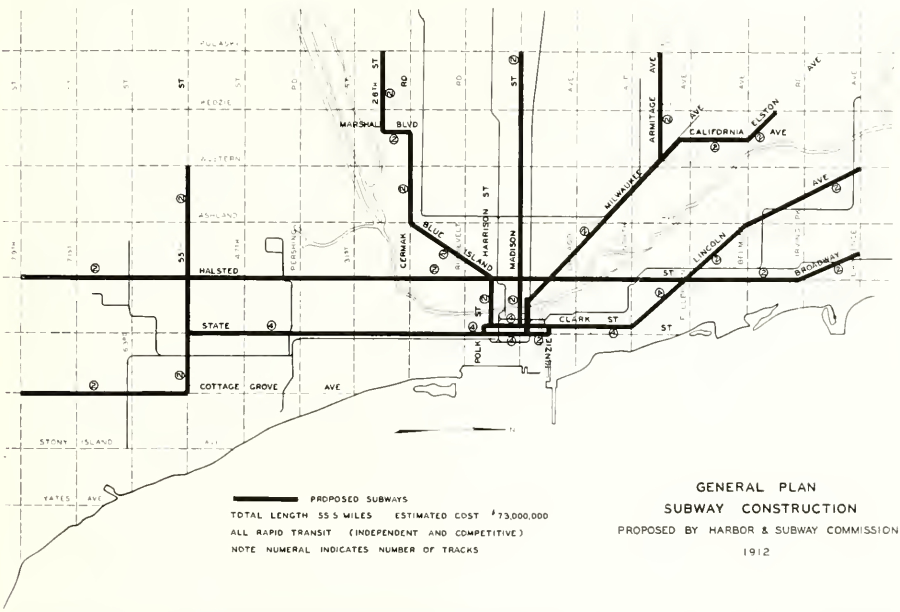
WABASH AVENUE LENGTH 5.6 MILES ESTIMATED COST $17,300,000

WEST SIDE LOOP LENGTH 6.1 MILES ESTIMATED COST 18,700,000

$38,000,000

NOTE NUMERAL INDICATES NUMBER OF TRACKS

GENERAL PLAN
SUBWAY CONSTRUCTION
PROPOSED UNDER THE ERICSON PLAN
1909



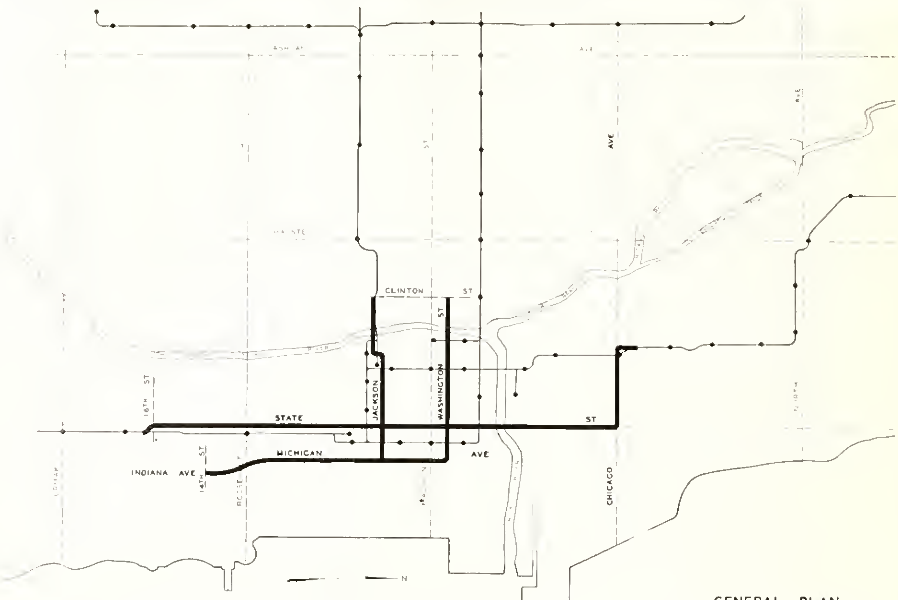
PROPOSED SUBWAYS

TOTAL LENGTH 55.5 MILES ESTIMATED COST $73,000,000

ALL RAPID TRANSIT (INDEPENDENT AND COMPETITIVE)

NOTE NUMERAL INDICATES NUMBER OF TRACKS

GENERAL PLAN
SUBWAY CONSTRUCTION
PROPOSED BY HARBOR & SUBWAY COMMISSION
1912



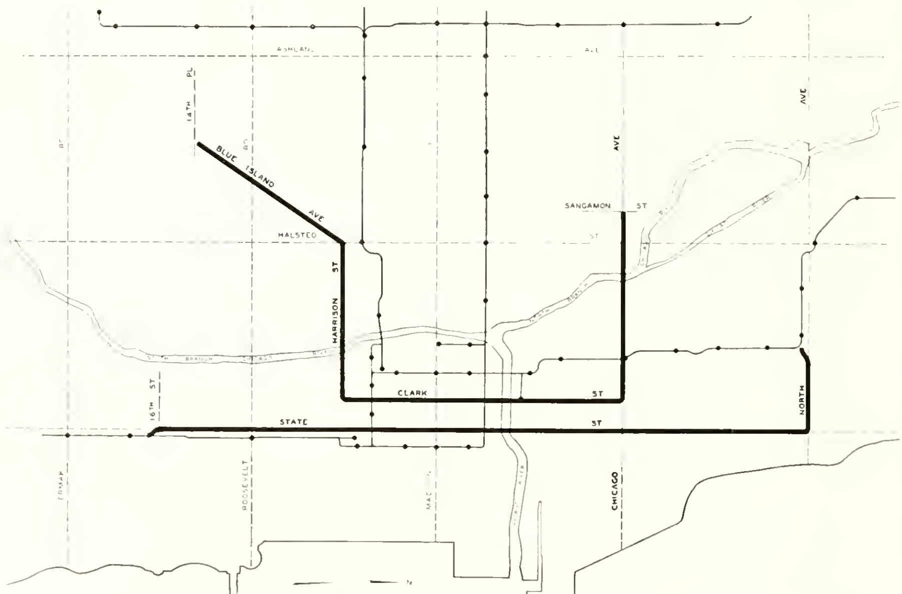
PROPOSED SUBWAYS

(RAPID TRANSIT) STATE STREET LENGTH 3.0 MILES ESTIMATED COST $10,350,000

STREET CAR SUBWAYS LENGTH 3.1 MILES ESTIMATED COST $9,370,000

NOTE ALL SUBWAYS 2 TRACK

GENERAL PLAN
SUBWAY CONSTRUCTION
PROPOSED IN 1916 TRACTION PLAN



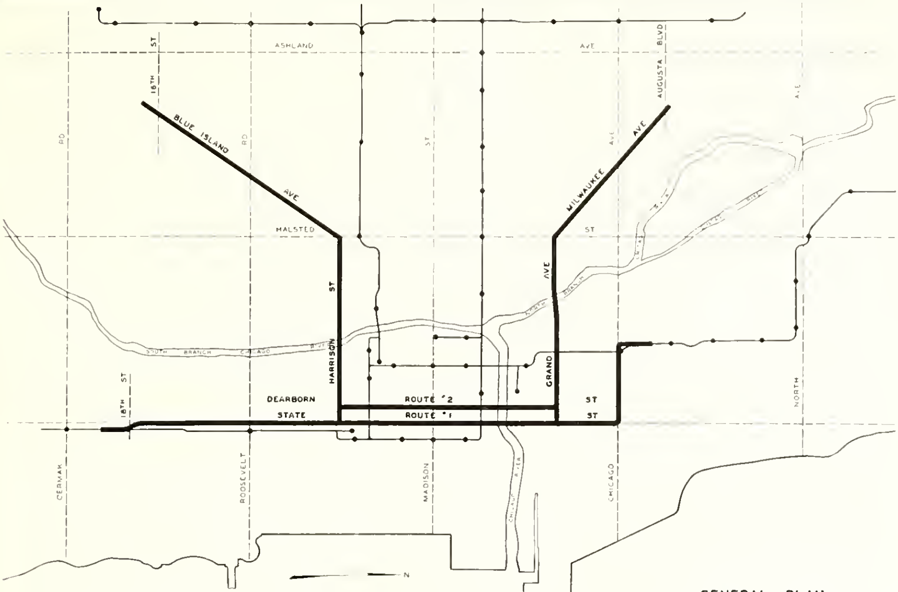
PROPOSED SUBWAYS

(RAPID TRANSIT) STATE STREET LENGTH 4.0 MILES ESTIMATED COST $19,500,000

(RAPID TRANSIT) WEST SIDE LENGTH 4.3 MILES ESTIMATED COST $25,500,000

NOTE 2 TRACK SUBWAYS EXCEPT BETWEEN HARRISON & RANDOLPH STREETS WHERE 4 TRACKS WERE PROPOSED

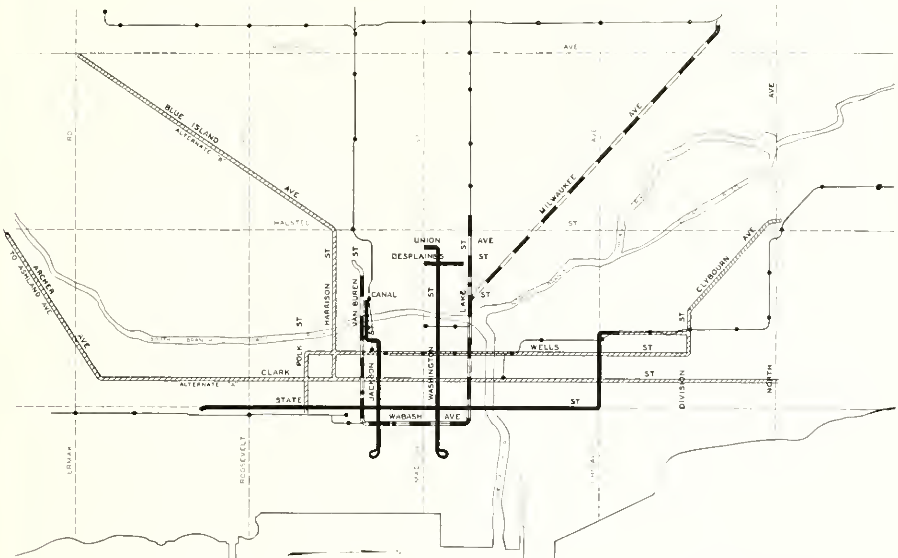
GENERAL PLAN
SUBWAY CONSTRUCTION
PROPOSED IN 1923 TRACTION PLAN



SUBWAY

(RAPID TRANSIT) ROUTE #1 LENGTH 3.4 MILES ESTIMATED COST $44,500,000
(RAPID TRANSIT) ROUTE #2 LENGTH 5.3 MILES ESTIMATED COST $32,660,000
NOTE: ROUTE #1—4 TRACK
ROUTE #2—2 TRACK

GENERAL PLAN
SUBWAY CONSTRUCTION
PROPOSED IN 1930 TRACTION ORDINANCE



PROPOSED SUBWAYS
PROPOSED FUTURE CONSTRUCTION
ULTIMATE PLAN

(RAPID TRANSIT)	STATE STREET	LENGTH 2.7 MILES	ESTIMATED COST	$19,140,000
(STREET CAR)	WASHINGTON STREET	LENGTH 1.7 MILES	ESTIMATED COST	7,185,000
(STREET CAR)	JACKSON STREET	LENGTH 1.3 MILES	ESTIMATED COST	5,515,000
(RAPID TRANSIT)	WEST SIDE (FUTURE)	LENGTH 4.3 MILES	ESTIMATED COST	33,000,000
	NOTE: ALL SUBWAYS 2 TRACK			$64,840,000

GENERAL PLAN
SUBWAY CONSTRUCTION
PROPOSED IN 1937 TRACTION PLAN

Chicago Traction and Subway Commission, developed in 1916 after an intensive study of traffic conditions, made definite provision for street car subways.

The present subway plans may be said to have been initiated with the report of November 22, 1937, by the engineers for the Committee on Local Transportation of the City Council, City of Chicago, wherein was submitted to the committee a comprehensive local transportation plan for the City of Chicago. This plan provided for the initial construction of a two-track rapid transit subway in State street and street car subways in Washington and Jackson streets. This plan formed the basis for present negotiations with the local transit companies for unified operation and modernization. It has since been amplified to include additional subway routes after the completion of the initial subways.

The Complete City Plan

The three subways proposed by the City for initial construction were:

(a) A two-track subway for rapid transit use in Chicago avenue from Franklin street to State street and in State street from Chicago avenue to 13th street;

(b) A subway for street car use in Washington street from Union avenue to a point in Grant Park immediately east of Michigan boulevard;

(c) A subway for street car use in Jackson and Franklin streets utilizing the Van Buren street tunnel under the river, extending from Clinton street on the west to a terminal in Grant Park just east of Michigan boulevard.

These subways were to be part of a major comprehensive transportation plan. The general scheme was to construct all north-south subways in the loop at high level, with east-west subways passing underneath at low level.

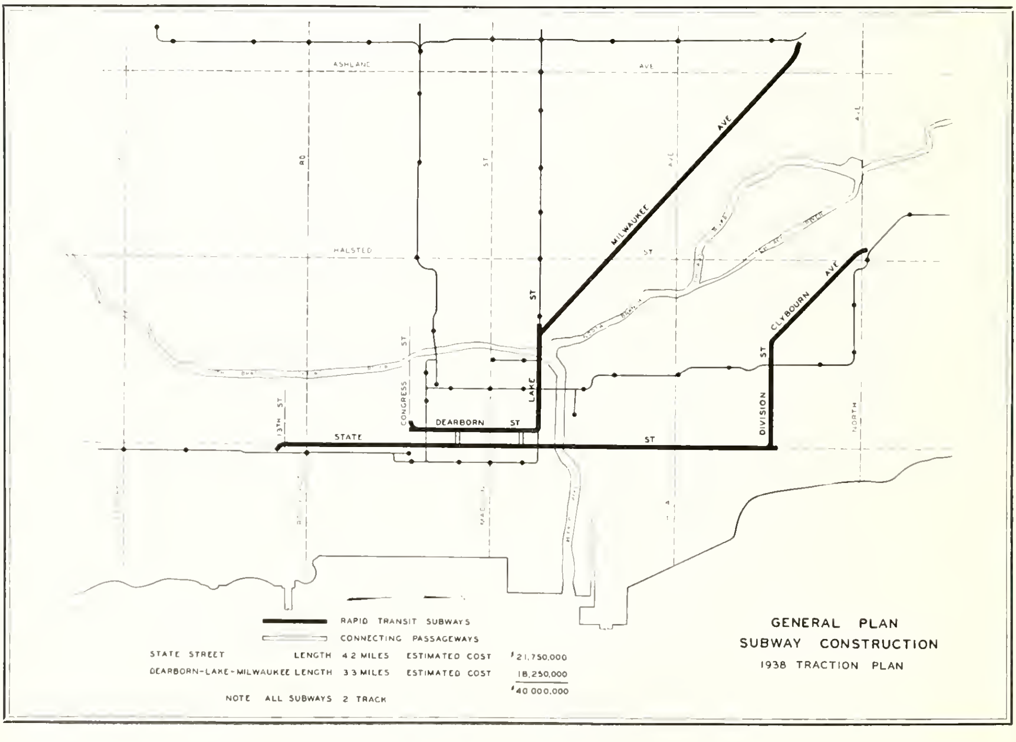
It was contemplated that the fourth subway to be built would be the west side rapid transit subway from a connection with the Lake street elevated line near Halsted street, thence over Lake street, Wabash avenue, and Van Buren street and curving south to Tilden street, thence on Tilden street connecting with the elevated structure near Halsted street. A connecting subway as a portion of this fourth route would be constructed over Milwaukee avenue, connecting with the present Logan Square branch of the elevated railroad near Ellen street, thence southeasterly in Milwaukee avenue connecting with the proposed West Side rapid transit subway near Lake street. The complete construction of this fourth subway would permit the removal of the east and north sides of the elevated loop structure.

It was contemplated that a fifth subway be constructed from a connection with the elevated structure near North avenue and Halsted street, thence over Clybourn avenue, Wells street, and Polk street, connecting with the elevated structure near Polk street and Wabash avenue.

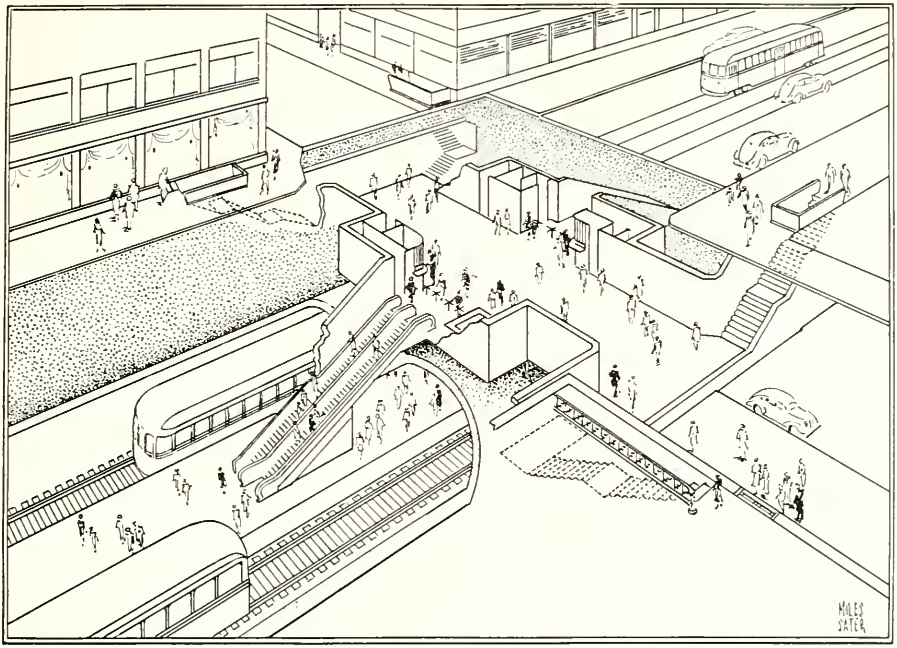
A sixth subway was projected from the intersection of North avenue and Clark street, thence in Clark street to Harrison street, with Alternate Route (a) via Harrison street and Blue Island avenue to Ashland avenue, or Alternate Route (b) via Clark street and Archer avenue to Ashland avenue.

Plans of P. W. A.

On June 15, 1937, the City filed an application with the Federal Emergency Administration of Public Works for a loan of $27,500,000 and a grant of $22,500,000 for the construction of the State street, Washington street, and Jackson street subways and the major portion of the west side subway. An amended application was filed on June 18, 1938, requesting a grant of $14,328,000 for the construction of the State street, Washington



GENERAL PLAN
SUBWAY CONSTRUCTION
1938 TRACTION PLAN



SUGGESTED · TREATMENT · OF PROPOSED · SUBWAY · STATION

street, and Jackson street subways at a total estimated cost of $31,840,000.

The Federal Administrator of Public Works appointed a subway commission, which reported on September 23, 1938, outlining two plans, both of which recommended the extension of the State street subway on the north over State street, Division street, and Clybourn avenue to North avenue. The commission suggested that the construction of the street car subways be deferred but that a rapid transit subway be constructed either from Lake and Halsted streets via Lake street, and Dearborn street to Adams and Dearborn streets (Plan 1) or from Milwaukee and Paulina streets via Milwaukee avenue, Lake street, and Dearborn street to Dearborn and Congress streets (Plan 2). The commission favors the tunneling method of construction throughout, with low level platforms reached through a station at mezzanine level.

Subsequently the City filed an amended application on October 4, 1938, requesting a grant of $18,000,000 for the construction of the subways in accordance with the commission's Plan 2, requiring an estimated expenditure of $40,000,000 in all. The Administrator of Public Works Administration recommended to the president of the United States that the grant be made, and it was subsequently approved on October 13, 1938.

Comparison of Plans

All the subways recommended in both the City's plan and the plan of the P. W. A. subway commission are two-track subways. It may be noted that the two plans are similar for the same sections of the city that are covered. The only major difference is in the matter of priority of construction.

The State street subway recommended by the City for initial construction was included in the P. W. A. subway commission's program, but it recommended that the extension to North avenue be carried out immediately.

The P. W. A. subway commission suggested that the two east-west street car subways recommended by the city engineers be postponed, and the Administrator of the P. W. A. has accepted those recommendations. They recommended that a substantial portion of the west side rapid transit subway be included in the initial program.

In deference to the wishes of the P. W. A. Administrator, the City Council and the Mayor on October 28, 1938, accepted as routes for initial construction those recommended by the subway commission, and it is expected that construction on these subways will be started in December, 1938.

Plan of Operation

While details of construction are still under final consideration and are subject to change at this writing, the general features may be broadly described at this time.

The subways which are to be constructed initially with the aid of a Federal P. W. A. grant are to be two-track subways. They are designed for use by rapid transit trains. It is contemplated that through trains will run over the elevated structure and into the subway via ramps and approaches at the connecting points. For example, trains from the north side, Evanston, Howard street, or Ravenswood, would enter the subway at Clybourn and North avenue and would emerge from the subway portal and reach the elevated structure over an approach near 13th and State streets, thence continue on the structure to Jackson Park and Englewood. The operation northbound would be over the same route in the reverse direction. This subway will provide capacity for all trains from the south side and for about two-thirds of the north side trains. It is expected that

(Turn to page 52)

Chasing The Fire Demon

by

Richard E. Vernor

ALTHOUGH the annual fire loss in the United States, expressed in dollars, is roughly only one-half what it was in 1926, there is no such startling contrast from the standpoint of deaths and injuries.

People are still looking into gas tanks with lighted matches, tossing cigarette butts about indiscriminately, throwing kerosene on hot coals, smoking in bed, dry-cleaning at home with gasoline, and are doing a thousand other silly things hardly compatible with an enlightened civilization. Result — 10,000 dead and three times that many injured. International Fire Prevention Week reminds us again that any way you look at the problem, even in 1938, it looms up sufficiently grave to challenge the attention of intelligent people.

Take a snapshot at it from the woods and you find that in 1937 we had over 63,000 forest fires of which 90% were man-made.

Look at it as a farmer and you see a 90 million dollar ash heap with 3,500 dead.

If you are a captain of industry you may as well know that over 40% of American industries suffering severe fire losses never resume operation.

Perhaps you are domestically inclined. We have had 300,000 American homes on fire in one year recently, and 60% of all the fire fatalities occurred in the home.

One out of every 75 schools in the country will probably be visited by the fire departments this year, and they will have their pumpers along with them.

Even in your automobile, fire is a menace. In Chicago alone, the Fire Department is called to extinguish fires in about 3,000 automobiles each year on the city's streets!

If your mind runs only to finances, we still send up nearly one million dollars every twenty-four hours into smoke, not to mention the staggering load of indirect losses resulting from the aftermath of fire.

If we could coolly survey ourselves through the telescope of seasoned perspective, we would probably conclude that the American people have in some respects gone berserk, for here we could see such scenes as a Texas school house exploding from accumulated natural gas; a fire truck and a street car in a hopeless tangle in Brooklyn as the result of a false alarm; or a blazing Atlanta hotel crackling amid the shrieks of more than a score who are losing their lives.

Fire occurs at strange moments. For instance, an interested spectator at a basket-ball game scratches his ear with a wooden match. The ball careens toward the man, strikes his head and ignites the match, burning the man's ear. In an eastern factory an employee, whose clothing is saturated in volatiles, reaches for his pay check. His static charge is communicated to the paymaster. The ensuing spark ignites the workman's clothing. Result serious burns. Two small children are left in a parked automobile. One of them plays with matches, ignites the upholstering, jumps out of the car, slams the door and the other child is cremated. A woman is heating gasoline on the stove. Her husband, seeing a blaze, throws the pan out of the back door just as the wife enters. Instantly she becomes a torch and another fatality is chalked up.

Four thousand years' experience with fire should have taught civilization to be careful.

Black as the picture is, we Americans have made some progress toward taming the Fire Demon. Science and engineering plus public education are doubtless responsible for considerable apparent improvement in the fire record, although experts keep their fingers crossed with an eye toward what may happen if and when industry forges ahead again.

More than fifty technical committees of the National Fire Protection Association constantly study safeguards for hazards and processes as well as construction. Constant engineering services to cities by the National Board of Fire Underwriters results in continuous improvement in precautions and extinguishing tech-

Conflagration by fireworks results in state-wide ban.

Modern training equipment improves the fire-fighter's efficiency. (Memphis, Tenn., drill tower.)

nique. Some 600 communities organized into a nation-wide Contest through local chambers of commerce by the National Fire Waste Council make a splendid contribution to fire safety locally. Countless devices are tested by Underwriters Laboratories, Inc., for their dependability and effectiveness. Hundreds of other groups make their contributions to the warfare against fire.

Obviously one way to control fire is to confine it. Fire-resistive construction helps do that. Proper building codes, if enforced, go a long way toward preventing the spread of fire. Extensive demolition programs in many of our cities have removed countless conflagration breeders, while fire-resistive buildings have broken up conflagration areas in many cities. As an example of these construction changes there is no longer even one fire company in the Chicago Loop.

Building codes and local ordinances are being constantly studied and modified in alert cities to take advantage of desirable new building materials, as well as to guard against new hazards. For instance, air-conditioning is a fine new science, but improperly installed it becomes a distinct fire hazard. Some musty building codes are still talking about livery stables, but make no reference to garages or oil storage.

The arson racket is growing constantly tougher for the criminal. Model arson laws have now been enacted in most of the states, and juries are discovering that crooked fires are at least as expensive to the community as other types. At least three scientific arson detection laboratories are pointing the way to more certain apprehension of the arsonist. Gangs of professional fire-bugs have been broken up in most of our larger cities.

Another way to checkmate the Fire Demon is to provide effective means for prompt detection and extinguishment. Numerous approved automatic alarm and control mechanisms are doing their part to put out fire once started, one of the oldest of which, of course, is the automatic sprinkler. First aid fire appliances are now in widespread use, although much more attention must be given to education as to their proper use. Even the electric eye is taking its place as a smoke detector. One of our prominent public officials who likes to smoke in bed is guarded by just such an automatic watchman.

Of course, the best known extinguishment agency is the fire department. Yet it is strange how many of our citizens are unaware of the amazing evolution through which the fire departments of the country have been passing. Over 60,000 firemen attended state and regional fire colleges this year, where they studied modern evolutions, salvage, ventilation, practical hydraulics, first aid and life saving, rope and rescue work, and a myriad of other subjects.

With over seventeen types of refrigerants in use, some of which are toxic, some inflammable and some explosive, it becomes vitally important that the modern fireman knows how to protect himself in the presence of each. Glass block construction presents new problems to him of forcible entry and rescue work. Modern complex traffic congestion also demands

Lack of fire prevention results in complete destruction of school.

Delay in reporting hotel fire resulted in loss of many human lives.

his study, as do inspection work and many other problems.

Hence it is no great surprise that out of 200 applicants for positions recently on the New York City Fire Department, 59 were college graduates. Fire extinguishment is at last becoming an engineering science as Chief Officer Shaw of the London Fire Brigade predicted when he visited this country as far back as 1873. The Oklahoma City Fire Department has 115 college men in its ranks. The University of Maryland now has a Professor of Fire Service Extension and is conducting evening classes for firemen, while Oklahoma A. and M. College is embarking upon its second year of pioneering with a two-year regular college course in Modern Firemanship. Aside from all this, almost every state in the Union now conducts through one auspice or another these short courses for firemen.

Absence of adequate cut-offs prevents confinement of fire in city blocks.

Modern fires are usually not the fascinating entertainment for the spectators which they formerly were, but the fire is put out with far less damage and expense to the community.

The other way to combat fire waste, and perhaps the most effective of any, is to prevent the fire from happening at all. This is easier said than done, but as most fire deaths occur before the fire department can arrive on the scene, it becomes terribly important.

That entire communities can be aroused to a definite fire safety consciousness has been actually demonstrated. Lakewood, Ohio, for the past 20 years has had only two fires where the loss has exceeded $1,600. Small wonder that Lakewood, with its 70,000 population of proud citizens has won ten bronze placques from the United States Chamber of Commerce! Albany, Georgia, has a record equally startling. There, even a night fire patrol is maintained, through which several fires have been discovered in their incipiency.

Through the work of hundreds of national, state, and local organizations, both urban and rural, millions of our population are being educated fire safety-wise by means of radio, the press, home inspection blanks, posters, contests, demonstrations, motion pictures, dramas, and addresses. "Smoky" Rogers, the Fire Clown of the Western Actuarial Bureau, has reached over three million school children in the first six grades in the middle west. A dozen specific examples of actual life saving as the result of his dramatization are on record.

During International Fire Prevention Week, the loss curve dips appreciably and consistently, proving that when the public mind can be directed to the cause of fire prevention, there are definite results accomplished.

But let's make it 52 weeks in the year. Our very lives are in the balance.

ANNUAL HOMECOMING

For Old Grads and Former Students of Armour Tech

See Announcement on page 28

THE EVOLUTION OF FACTORY LIGHTING

by

Ralph G. Raymond

THE history of artificial factory lighting practice, just like the history of civilization, has been an evolutionary process. One, of course, has developed over a long period of years, the other over a much shorter period. Factory lighting practice, like civilization, may be broken down into eras; and, finally, the parallel holds in that examples of each of these eras can be found in use today existing side by side.

The eras of factory lighting practice might be called the primitive, the empirical, and the scientific. Early or primitive industrial lighting practice consisted of hanging a lamp, perhaps shaped, but probably not, over the machine or wherever work was going on. In the early days of artificial electric lighting, this practice was justified on the basis that lamps and power with which to operate them was too expensive to provide light any other place than where it was needed. But over a period of years lamp and power costs dropped to a fraction of their former value; and experimental work that was carried on seemed to indicate eyes saw not only what they were looking at directly, but saw a considerably larger field surrounding the area of concentration. Thus it seemed that easiest seeing could be accomplished when the surroundings as well as the objects to be seen were lighted. As a result of this lowered cost of artificial light and the pregmatic determination that general lighting was conducive to better seeing than mere wads of light on the area of immediate concern, local lighting was abandoned in favor of general lighting. Thus it came about that the primitive era of factory lighting passed along.

Drop cords were replaced by porcelain enameled reflectors with or without diffusing glass bowls. These reflectors were hung in factories so that uniform lighting was provided. At the beginning of this new era factory executives were impressed with the battery operated grease spot type of measuring meter. They were not too much distressed by the fact that the accuracy of the measurements made with these meters might be plus or minus 50%. And when owners of these meters were confronted with the question of how much light a factory area should have, the reply might have been 5, 10, 15, or 25 foot candles, depending on the year the question was asked. Factory lighting practice had reached the empirical stage of its evolutionary development.

The peak of this second era of industrial lighting, the empirical age, characterized by 100 to 500 watt lamps placed in standardized porcelain enamel reflectors with or without diffusing glassware surrounding the lamp and so spaced and hung as to provide almost uniform lighting in the factory area, was reached at the peak of the last general era of economic prosperity in 1929. Much like our economic prosperity of the time, this lighting success was in some respects false. Many lighting practitioners came to believe that general lighting was the complete answer, when, as a matter of fact, it was later revealed to be but a portion of the answer in too many cases. But, fortunately the general lighting scheme turned out to be the foundation on which to build an adequate factory lighting system.

Economic success is frequently accompanied by the smug belief that all progress is at an end, whereas economic distress frequently stimulates research and paves the way to further progress. Such might have been the reasons for a return to the findings of research in industrial lighting, but in each of the revivals and entries into a new era of evolutionary development prophets precede the pack.

Naming prophets is an exceedingly dangerous procedure, but in the case of industrial lighting little doubt exists that Dr. M. Luckiesh and his associates from the Research Laboratories of the General Electric Company sounded the warning cry in the advancement of the "general lighting plus" idea for industrial lighting in 1926. Possibly the rumblings of too frequent failures of general lighting alone coupled with research findings not yet completely verified, but to be confirmed and announced within a few years, prompted their prophetic utterings.

Soon others took up the cry. Something had to be done. In the confines of meetings of illuminating engineers, the paramount questions were—"What

Glare and gloom prevail in typical factory lighting of the primitive era.

A factory lighted in the empirical stage of industrial lighting evolution. Note that the general lighting of a fairly high order from well designed reflectors still left something to be desired.

ascertain what was needed. The first to be investigated was the printing industry. The Society's Industrial and School Lighting Committee, under the leadership of Prof. H. B. Dates, selected test cities and made a survey of existing conditions. It was found that lighting was at a dangerously low ebb. Out of some 2,500 printing plants visited, the average level of illumination was only 2.85 foot candles; and the lighting equipment had an average age of 8.7 years.

Now, a comparison of the average foot-candles of illumination provided in the printing industry with the amount indicated as essential for easiest seeing in the basic researches pointed out that the prevailing light provided in printing plants was woefully inadequate.

In order to check this conclusion, trial step up of lighting intensities in test printing plants with existing equipment was tried. In some locations the increased illumination did result in increased ease of seeing, decreased worker fatigue, decreased waste, and increased production—just as basic researches in seeing predicted. But increasing intensities with existing equipment over type cases and composing stones in these same test plants did little to improve seeing conditions.

Upon further investigation, it became apparent that the places where practice failed to follow theory were places where operations of a highly specialized nature were being conducted. Perhaps, conjectured the investigators, the theory is still right, but the equipment is wrong. Playing this hunch the investigators went back to the test plants determined to find

is the *plus* of general lighting plus? How is the problem to be attacked? Where do we start?"

During this same period of time many fundamental developments had taken place, which gave "General lighting plus" teeth. A new foot candle meter, a visibility meter, and a scientific knowledge of seeing paved the way for a quantitative and qualitative method of research in industrial lighting.

The inaccurate grease spot foot candle meter was replaced by light sensitive cell meters. The human element which entered into the gauging of grease spots was eliminated. The new light sensitive meter had simplified the measurement of intensities, and the results could be depended upon.

A visibility meter, which used a standard test to indicate what intensity was needed, gave the engineers an opportunity to determine what various tasks required. This provided a basis for recommendations. Here again we see evidence of the fact that lighting was leaving the era of empiricism and entering that of an exacting science.

One more important element which may be thought of as the all embracing element is the Science of Seeing. After years spent in conducting tests, gathering material, and interpreting the data, something fundamental was learned about seeing. It was found that tests had to be weighted carefully if the human element was to be eliminated. Out of all this research it was learned that such things as brightness, contrast, speed of vision, and intensities were all directly linked to one another. Prior to this discovery, intensity was the all important element; and it did not solve all the problems. That was the reason for determining the role that all of the elements played in seeing.

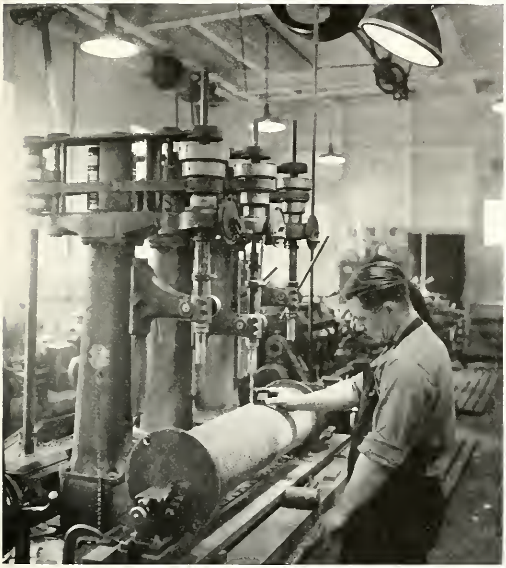
Soon after the appreciation of the new tools that the illuminating engineers had at their disposal they put them to use. The Illuminating Engineering Society decided to conduct various tests in the industrial field to

The large area low brightness fixture gives good account of itself in buffing and polishing operations.

out the ins and outs of seeing in these highly specialized locations. When they had finished, some thought they were as well qualified to be printers as illuminating engineers, but nevertheless they had the answer, and the answer was the design and production of entirely new types of lighting equipment for these specialized locations where theory had heretofore failed.

Then followed the Committee's report, "Lighting Practice for the Printing Industry." It was published for the benefit of the Society's members and others interested in knowing what had been accomplished. As a result, there are great numbers of printing plants today that have recognized the influence of light on production. They have applied the knowledge gained.

Color matching made much easier by use of fluorescent daylight lamps.



A well designed general lighting system with auxiliary reflectors producing potent seeing light at the work point, is typical of the scientific era.

and many are in close contact with the Society so that they can be abreast of the newer developments.

But the Illuminating Engineering Society did not stop its work when the investigation of the printing industry was completed. Other committees were formed, and similar investigations of lighting for the Shoe Manufacturing, the Cotton Weaving, the Machinery and Small Parts, and the Radio industries were conducted. The findings in all these industries have been published and are available to anyone interested. Others are now in the process of completion. No doubt this work of the Society will never be completed. New industries, new lighting facts, new light sources will continue to be introduced, but these investigations, in the opinion of many, mark the start of the scientific era in industrial lighting practice.

No attempt is made here to explain in detail the tests that were conducted in these investigations. That would lead to something like a thesis. It would deal with reflection factors and types of reflection: specular, diffuse, etc. It would also cite the behavior of different materials under different light conditions. Brightness values would be given on all operations studied. All of the reports are available to whoever wishes more information about the technicalities involved.

It was mentioned earlier that new equipment has been designed depending on the need. In a sense this new equipment is the plus of "general lighting plus." We shall not consider any specific case which necessitated the use of special equipment, but deal with the innovations in a general way. There were operations found in industry that could be done to a higher degree of satisfaction with use of hoods and other large area light sources. This equipment was designed according to the scientific principles involved. Brightness, intensity, efficiency, and quality were all combined in the large area equipment. Many types were finally developed; and naturally, too, other applications were found for them. They are used in inspection, assembly lines, drafting rooms, and other places where the characteristics of these units were desired.

Problems such as getting a concentrated beam of light on a lathe bed, punch press, and other machines led to the development of intensifiers—another plus lighting fixture. Practically all the intensifiers call into play the parabolic reflector. This, of course, being one of the best methods of concentrating the light, is used widely wherever supplementary lighting is needed.

Position of the units, direction of the light, and type of operation to be done were factors that had to be considered in their development.

This development was not only in reflector equipment, but in the light sources themselves. Newer and efficient means were introduced to do specific jobs well. At the same time improvements were being made on existing sources. The high intensity

mercury vapor lamp offered itself for use in high mountings, as in foundries. The mercury vapor lamp has a characteristic blue-green color. This perhaps limits its use to operations which do not need a white quality of light. This limitation has been overcome by the use of combination units. These reflectors use the light of both the incandescent and mercury lamps. Proper combination of the two produces an approximate daylight quality of light, which can be used well in types of inspection and also in color work.

The blue glass daylight incandescent lamp, again an approximation, is used where its color quality is adaptable. Other means of approaching the color quality of daylight are the color filters. Considerable research has been carried on with glass filters. They have been developed to the point where the quality is good. Their use is well worth while in many instances. There are some problems, however, which they do not solve too well.

The newest development in the production of white light is the fluorescent lamp. The daylight fluorescent lamp has been found to have the best color quality and highest efficiency as compared to the other methods. It has already produced better results in types of inspection work than had been realized before. The possibilities of using this new light source in industry are being discovered day by day. It has been built into hood units already. This serves a double purpose in that the color quality is good and it satisfies the need of a large area unit.

Lighting fixtures of large area and low brightness solve the seeing problem over composing stones and type racks in the printing industry.

This had been a rather brief mention of equipment and applications because of the impossibility of treating the subject in a general way. At any rate, one will appreciate that the illuminating Engineering Society has attained a degree of success in this undertaking. Even now, new sources and reflector equipment are under development in the laboratories.

It would not be enough to say that the new equipment and methods have done and are doing a good job without mentioning the value of it. Industry profits with the use of good lighting. The profit is not composed entirely of the favorable influx of money, but it comprises to a great extent the savings that it brings about. Waste is reduced to a remarkable degree. The efficiency of the men at work is increased. These things alone have a direct relationship on production. There have been percentages recorded on the increases. There are variations, as might be expected, but the increase is present.

Radio assembly is made easy with another variety of the large area low brightness lighting fixture.

Another element that has been given attention in industry is Safety. How does lighting enter into this subject of reducing accidents which cost industry over a billion and quarter dollars each year? The National Safety Council reports that 5% of the total, or $75,000,000, is spent on accidents due to poor lighting. The men are not able to get a clear, well-lighted view of their machine operations. They cannot see objects set about, which are in shadows and which may prove to be stumbling blocks. Many examples of poor lighting and the resulting accidents could be listed.

The interesting thing is that about half, or approximately $45,000,000, would remedy the lighting condition which leads to the $75,000,000 loss due to accidents. Even though we have dealt with accidents from the viewpoint of cost, the humanitarian element should also hold an important position leading to a corrected situation.

Many examples can be quoted of actual installations that verify all that has been said. It is verified in one re-

(Turn to page 58)

OXY ACETYLENE PROCESS

"HAMMER AND SAW" FOR METALS

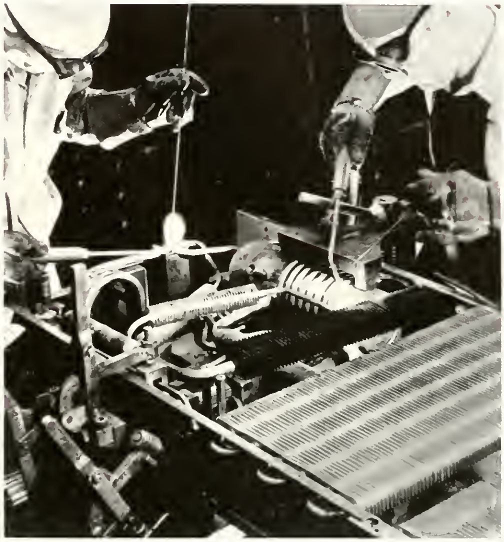
by

John F. Galbraith

OXY-ACETYLENE welding and cutting is a most important process in all metal-working industries. It is the "hammer and saw" for metals and is a necessary adjunct wherever metal is to be cut or joined. The process is used for welding practically all commercial metals and for cutting of steel, wrought iron, and cast iron.

The combustion of suitably regulated mixtures of oxygen and acetylene produces the oxy-acetylene flame, which has a temperature range of about 5,500-5,600 deg. F., the highest obtainable by the combustion of any gases now known to science. The high temperature of this flame, sufficient to melt easily any metal, even platinum, is the foundation upon which the oxy-acetylene industry has been built.

For welding and cutting operations, acetylene may be obtained in two ways. Whenever conditions warrant, acetylene is produced directly from calcium carbide, using for this purpose a standard acetylene-generator. However, where portability is a factor and wherever comparatively small quantities are required, acetylene may be purchased in cylinders. These cylinders are completely filled with a highly porous material saturated with acetone, a liquid in which the acetylene gas is dissolved.



Production welding of refrigerator assemblies is aided by the use of jigs.

Oxygen is one of the most common of all chemical elements. It is a colorless, odorless, tasteless gas and comprises approximately one-fifth of the air that we breathe. The bulk of commercial oxygen is obtained from the air by the liquid air process. At extremely low temperatures, air becomes a liquid, being a mixture of liquid oxygen, liquid nitrogen, and small quantities of rare gases. From this mixture pure oxygen is separated by a process known as "rectification". For distribution, oxygen is compressed into steel cylinders

Building-up of screw conveyor flights gives longer life and saves the cost of replacement.

Oxy-Acetylene Welding

An oxy-acetylene welding blowpipe is an instrument for mixing oxygen and acetylene gas in the correct proportions to produce a flame having the properties necessary for the work at hand. The blowpipe has a handle with two inlet connections for gases at one end. Each connection has a valve that controls the volume of oxygen or of acetylene passing through. By means of these valves, the desired proportions of oxygen and acetylene are allowed to flow through the blowpipe, where they are thoroughly mixed before issuing from the blowpipe at

Welding speeds the installation of piping systems.

the tip. For the majority of welding operations the flame should be neutral; that is, neither oxygen nor acetylene should be in excess. Occasionally, however, it is desirable to use a flame having a slight excess of either acetylene or oxygen. By means of pressure regulators and the valves on the blowpipe, the operator can control the character of the flame as desired.

The flame is applied to the edges of the two metal pieces to be joined. Because of the intensely concentrated heat, these edges quickly fuse together, and upon cooling, they solidify into one solid piece of homogeneous metal.

Steel shapes are quickly cut with the oxy-acetylene blowpipe.

One of the greatest advantages of the oxy-acetylene process is that all commercial metals can be welded; all steels, both hard and soft, wrought iron, cast iron, copper, aluminum, brass, and other alloys. Whenever the joint is to be made in metal more than 3/16 in. thick, it is necessary to bevel the edges in order to permit thorough fusion throughout the entire thickness of the pieces. In this case, the joint is first beveled to an included angle of approximately 70 degrees.

The metal removed during the beveling operation is replaced by metal from a rod called a welding rod. Since the desired result is a weld with properties as near like the base metal as possible, there is a special welding rod for each class of metal. In the welding of many metals, special chemical compounds, called fluxes, are also used. These react chemically with any oxides present and form a thin coating of fusible slag on the surface of the molten metal, which protects the metal underneath from further oxidation.

Oxy-acetylene welding has been adopted as an integral part of manufacturing processes in the production and assembly of such products as automobiles, airplanes, refrigerators, railway cars and equipment, pressure vessels, storage tanks, metal barrels, steel tubing, metal office furniture, and chemical and food utensils. The welded pipe joint is rapidly supplanting other types for oil, gas, water, and steam lines. In the iron and steel industry the process is of great economical importance in production, as well as in repairing and reclaiming plant equipment.

Overland pipe lines are made leakproof for the life of the pipe by welded construction.

Oxy-Acetylene Cutting

The oxy-acetylene cutting blowpipe differs from the welding blowpipe in that in addition to producing an oxy-acetylene flame, it also delivers a stream of pure oxygen through an orifice at high velocity to do the actual cutting. The oxy-acetylene flames or preheat flames are arranged in a circle around the jet of cutting oxygen.

The theory of oxy-acetylene cutting is quite simple. After a small spot of steel has been heated to a red heat, the jet of oxygen is directed against it. The iron and oxygen react instantly, producing so much heat that the iron oxide formed melts and runs away. The action is so rapid that a narrow slit or "kerf" is quickly cut through the steel. It is a chemical process and should not be confused with mere melting of the steel itself, which would be infinitely slower and quite impractical. The oxygen jet is maintained under sufficient pressure to blow away the oxide slag as fast as it is formed so that the kerf is kept open. To speed and facilitate the cutting operation, the preheat flames are kept burning all during the cut.

Any thickness of steel, wrought iron, or cast iron can be cut with the proper oxy-acetylene technique. Cutting heavy scrap metal to smaller size, removing "risers" from steel castings, coping I-beams and structural members, cutting off rivet heads and staybolts, nicking billets and cropping "blooms", and beveling parts preparatory to welding are typical applications of the cutting process. The oxy-acetylene blowpipe is an indispensable tool in scrapping and salvaging operations.

The mechanization of the cutting blowpipe so that parts are flame-cut automatically is a development of recent years. Shops employing flame-cutting machines have been able to increase production, in many cases without increasing existing production facilities. Furthermore, reduction of finished inventories and elimination of the risk of obsolete parts is possible because the flexibility of the flame-cutting machine has made "special order" manufacture practically as economical as "quantity" manufacture.

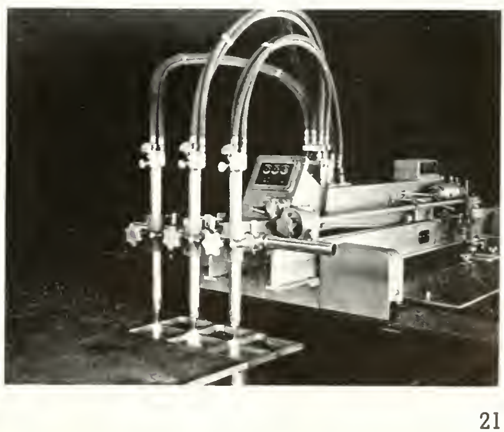
The oxy-acetylene cutting blowpipe is an indispensable tool in scrapping operations.

Automatic shape-cutting machines are driven by small electric motors. Whether guided by hand or following a templet, the machine moves the cutting blowpipe at the desired speed and results in a smooth and accurate cut. Shape-cutting machines assume different forms and types, depending upon the work to be done. There is a machine to perform every type of cutting job, regular or irregular, from light plate to heavy stock.

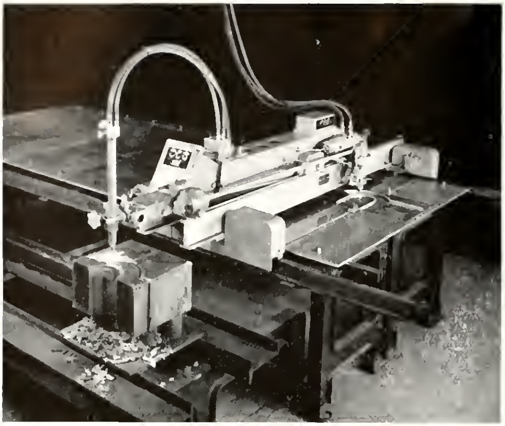
An important development is the portable oxy-acetylene cutting machine. This machine is light and can be moved from one job to the next regardless of the location of that job in the shop. When cutting irregular shapes, this machine is directed by hand, and the degree to which the machine can cut shapes of a simple or complex contour depends upon the skill and experience of the operator. For straight-line cuts, the wheels are locked in position and the machine is guided by an angle bar that serves as a track. The machine is also equipped to cut automatically circular shapes ranging in diameter from a few inches to several feet.

The portable cutting machine has many advantages, particularly on smaller jobs. The routing and transportation of materials is reduced to a minimum, since any desired shape can be cut and no supporting equipment for the machine is necessary.

For larger, heavier jobs, stationary flame cutting machines are employed. These are so equipped that the motion of the cutting flame is guided by hand, or the machine follows the line of a preformed templet and cuts shapes similar to this templet indefinitely. For this heavier work, the stock is placed on a supporting framework. The machine moves on tracks adjacent

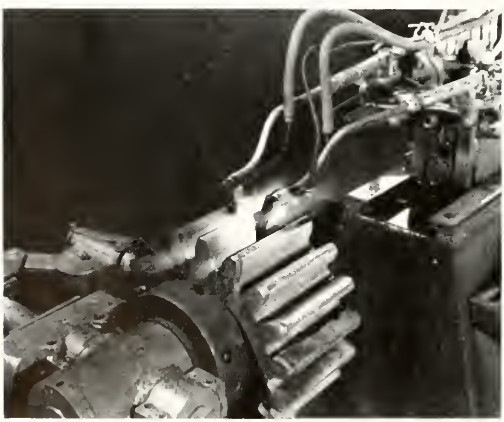


Multiple cutting of similar parts reduces production time and costs.



Parts of practically any shape and thickness are economically cut with the automatic shape-cutting machine.

Automatic circle cutting with a portable oxy-acetylene cutting machine.



The teeth of this spur gear are being flame hardened by the oxy-acetylene process.

to this supporting framework and has an extension arm holding one or more cutting blowpipes.

The possible uses of the most recent shape-cutting machines are almost unlimited. Complicated shapes are automatically followed with no attention from the operator. Automatic straight-line cuts can be made at any desired angle in the horizontal plane, and automatic bevel cutting in any direction without the use of templets is possible. For repetitive cutting on large scale production items, permanent templets are used. For special shapes, hand-tracing devices enable the operator to cut the desired shape by tracing directly from a blueprint or other drawing. For multiple cutting, two to five blowpipes are attached to the machine.

Oxy-Acetylene Flame Hardening

A very recent oxy-acetylene development is a procedure for flame hardening wearing surfaces of steel and cast iron parts. Flame hardening a process whereby the surface to be hardened is brought to a red heat in a relatively short time, usually less than 30 seconds, by means of the oxy-acetylene flame and then immediately quenched. A hard "case" is imparted to the steel surface without in any way altering the chemical composition of the steel or iron. However, the material must be of the proper composition to harden from heating and quenching.

Flame hardening is particularly suited to applications where a hard surface with a tough ductile core or body is desired. The hardening of wearing surfaces on steel parts that would be difficult, costly, or impossible to heat-treat by other means is readily done by flame hardening. Typical successful applications of flame hardening include: gear teeth of all sizes, cams and camshafts, mill rolls, crane and sheave wheels, dies, valve stems, and similar parts.

In addition to these production uses, broken machinery parts of all descriptions and from almost every kind of industry, as well as appliances used in every walk of life, are being prepared quickly and economically by oxy-acetylene welding and replaced in service at a small fraction of the expense of new equipment. Whether for joining metals or for severing them, the oxy-acetylene process, because of its economy, speed, and efficiency, has proved itself an indispensable tool to industry. It is undoubtedly one of the most important industrial developments of modern times.

AIR CONDITIONING AND INDUSTRIAL HYGIENE

by

W. H. Carrier

AIR conditioning was brought into being at the beginning of this century, some thirty years ago, because of a need in industrial processes. It was born of industry. It has more recently come into the limelight in the guise of a new industry because of its spectacular achievements in promoting human comfort. Its public acceptance has been primarily due to its popularization in theaters and railroad cars, and from this it has been extended to many other fields where public patronage is solicited.

There are at present at least three distinct fields in which it finds application: first, the original industrial field where products are primarily concerned; second, the commercial field where it pays its way by increasing patronage; and third, the personal or luxury field where it finds application in homes and private offices.

This art has become of great economic importance to those industries whose products are affected by weather conditions, as, for example, in all the textile industries, including rayon, which could not be manufactured successfully without it; in all parts of the tobacco industry, such as in the manufacture of cigars and cigarettes; in the printing and lithographing industry; in the manufacturing and processing of paper and paper products; in the manufacture of chocolate and confectionery; in the manufacture of gelatin products, such as capsules and photographic films . . . in fact, in a long list of over 100 different industries.

In these industries air conditioning pays for itself many times over in the improvement of quality and increase in production. In such industries the effect on the employe has either been overlooked or else considered of secondary importance. This is not as it should be, because improvement in product must not be made at the expense of human well-being; nor can the employer afford to overlook the real if sometimes intangible economic advantage of efficient and contented labor. Therefore, it is well to examine industrial air conditioning with relation to these facters as well as to its effect on the product.

In order that we may intelligently explore the possibilities and limitations of industrial air conditioning, it is well to consider briefly the fundamental principles and processes involved. Air conditioning for industry usually requires an exceedingly exact control of relative humidity, as this is the prime factor affecting hygroscopic materials. In certain products, however, uniform temperatures, either at a high or low level, may be desirable or necessary.

Many products such as cotton and tobacco require high humidities for successful processing. This was well recognized in the early attempt of the English manufacturer to add moisture to the air in his cotton spinning and weaving rooms. The only thought was to add moisture, and at first he used steam jets and vapor pots and sprinkled the floor in his endeavor to get moisture in the air. These crude methods only added more heat to an already overheated room. Later he improved this process by overhead atomizing sprays which absorbed some of the heat by evaporation, but the success of such means of humidification depended on minimizing ventilation which was necessary to remove the great amount of heat generated by his machinery. Working conditions became so bad in English mills that a commission was appointed by Parliament to study mill conditions and practices. As a result of the findings of this commission, a drastic law was passed prohibiting artificial humidification when specific room temperatures were exceeded.

While no corresponding law for the protection of the workers was ever put in force in this country, conditions here were nearly as bad, but in 1906, Stewart W. Cramer and the author devised systems of air conditioning for textile mills which would control temperature as well as humidity in an economical and practical manner. Mr. Cramer's system involved the use of room atomizing sprays with auxiliary mechanical ventilation. The author's system controlled both the temperature and the humidity by the introduction of cool, saturated air in sufficient quantities to remove the heat generated within the mill, and required *no sprays* or other means of humidification *within* the mill itself. This marked the advent of modern air conditioning.

This process of air conditioning in mills was based on the discovery of

With modern air conditioning manufacturing processes in the textile industry are no longer affected by nature's changes in atmosphere.

the fundamental principle that for any given relative humidity there was a definite temperature difference between the dewpoint and the room temperature . . . that is, between the temperature of the saturated air introduced and the temperature of the room. For example, if a relative humidity of 70% is to be maintained, then the difference between dewpoint temperature and the room temperature must be approximately 11½°. In other words, enough saturated air must be introduced into the room or mill to cool that room within 11½° of the temperature of the saturated air. In winter both the temperature of the saturated air and the room temperature was controlled, but in the summer all outside air was employed so that the air could be saturated at the lowest temperature practicable without the use of refrigeration.

The second discovery in relation to this process of air conditioning was also to be of great importance to industry and to the art of air conditioning; that is, when air is passed through a spray of recirculated water and brought substantially to the point of saturation, it will always be cooled to the outside wet bulb temperature. The wet bulb temperature is the temperature indicated by a thermometer covered by a wetted wick. This thermometer will read from 10° to 30° lower than the dry bulb thermometer, depending upon the dryness of the outside air. The average maximum wet bulb temperatures during the hottest months vary from 65° to 70° in different parts of the United States, and there are but few days when the maximum wet bulb temperature exceeds 75°. This will give some idea of the temperatures which are available for air conditioning without refrigeration for mills in the United States. For example, the average mill temperature where 70% relative humidity is being maintained by the process described would be from 76° to 81°, not an entirely comfortable temperature but a practicable, healthful, working temperature, . . . a very much more comfortable and healthful condition, by the way, than is found in unconditioned mills without humidification.

The principle of the humidifier used in cooling and saturating the air is that evaporation is a cooling process in which the sensible heat of the air is converted into latent heat of water vapor. The degree of cooling thus obtained obviously depends upon the dryness of the outdoor air entering the humidifier and may be expressed by an exact mathematical formula. The Carrier process is now in general use in industry in all parts of the world. Where lower temperatures are required in the room, the air is further cooled by refrigeration of the water spray which makes it possible to control at any desired fixed temperature as well as at any desired relative humidity.

It should be noted that the requirements and the equipment for air conditioning in industry are frequently quite different from those required in commercial air conditioning for human comfort. Air conditioning for human comfort does not require an exact relative humidity, but while this can be somewhat variable, it should be relatively low, as compared with the conditions in textile mills, for example.

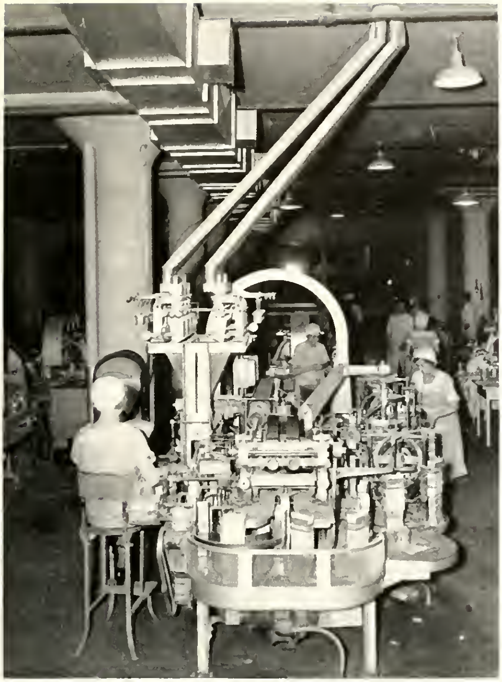
The system of evaporative cooling so successfully used for high humidities in industry is generally unsatisfactory in air conditioning for human comfort, the exception being in hot dry climates. In industrial humidification the room temperature is allowed to vary with the outside temperature, and large volumes of air are employed to remove heat and to maintain the high humidities. In cooling installations for comfort, relatively small quantities of dehumidified air are employed, and the temperature is definitely controllable within the comfort range. In another class of industries, however, even a more exact temperature control is required than in comfort installations. Where cigar and cigarette machines are employed, uniform temperature is necessary for maximum production. In chocolate factories a uniform temperature at 65° is necessary with low relative humidity to give the best product.

Can the requirements for the processing of materials be reconciled with those of the comfort and efficiency of the operatives? We have already seen that better working conditions have been produced in textile mills than existed before the advent of modern air conditioning. Temperatures in mill practice are considerably lower than the maximum outdoor temperatures, while under average summer weather conditions they do not greatly exceed outdoor temperatures.

Under the management of a large manufacturing establishment in Virginia there were, side by side, an old cotton mill and a new cotton mill that was air conditioned by modern methods. The improvement in the working conditions in the new mill was so great that it was found to be a real inducement to workers. As a result there was always a waiting list of applicants from which the most skilled and efficient workers could be selected. Obviously this condition greatly improved the efficiency of this particular mill apart from the gain due to the better processing of the product.

Prior to the advent of air conditioning, tobacco stemming rooms had

Air conditioning provides uniform high humidity required for successful processing of tobacco.



Uniformity of quality of food products is more easily controlled by proper air conditioning.

never been humidified. Not only was there a loss from the breakage of the leaf in process, but the dust conditions were the most terrible that could be imagined. One could not see half the length of the room. The operatives worked with handkerchiefs tied over their mouths, using them as homemade respirators. Air conditioning was installed to remove the dust through high humidities and rapid air change. As a result, the room was clear and operative could work in it without any discomfort or ill effects; moreover, loss by breakage was sufficiently reduced to pay for the installation. Not only was the air in this room freed from dust, but it was comfortably cooled in summer, so much so, that workmen from other parts of the factory went into this room to eat their lunch on hot days. This is an excellent example of combining benefits to the product with improved hygienic conditions for the operative.

In industries where high humidities and higher than average temperatures are employed, it is desirable that dressing rooms be provided so that the workers can change to dry, warm clothing before going out of doors. This is the practice in many of the best textile mills. Where this precaution is taken no ill effects are experienced by the workers from the high humidities even during cold winter months. In chocolate factories, where the room temperature must necessarily be 65°, the workers provide themselves with additional clothing, and because of the uniformity of the working temperature no ill effects are experienced; in fact, the health of the workers seems to be better than where they are working under higher but variable temperatures.

In the installation of the air conditioning plant in the Robinson Deep, a gold mine on the Rand, 8500 ft. deep, the air entering the shaft at the surface is cooled uniformly throughout the year to a temperature of 35°. This permits the efficient operation of the mine at its greatest depth, although the temperature rises to 86° because of the compression of the air and the heat from the rocks. The native miners coming from these hot humid depths are brought up through the cold shaft to the surface at the end of the shift, and there were considerable misgivings on the part of the management when this installation was made, that such a severe change in temperature might increase illness and the incidence of pneumonia already prevalent among the miners.

As a partial safeguard against this possibility, a rest room was provided at the 4000 ft. level, and all workers were required to put on warm sheepskin jackets provided by the Company before they ascended through the cold air shaft to the surface.

The medical statistics in connection with this operation are most interesting. The same Company operates two separate shafts—the Turf shaft, where the cooling plant is installed, and the Chris shaft, which has no cooling plant. Each shaft has its own compound where the native labor force is housed. Their medical report states: "There has been a slight increase in the incidence of pneumonia at the main compound where the Chris labor force is housed, but in the Turf compound the incidence dropped from 58.4 per thousand during 1935 to 34.4 per thousand in 1936." This is a decrease of over 40% in the incidence of pneumonia as compared with former records,—a most interesting result directly contrary to expectations.

In industries involving high temperatures, such as steel rolling mills, for example, it would be impossible to operate in semi-tropical climates during a considerable portion of the year without the art of air conditioning. A good example of this is the great Tata Steel Company in India, the largest steel plant in the British empire. This plant was necessarily shut down during the hot monsoon season, but by the aid of air conditioning it was able to operate continuously. Here large volumes of air are drawn through humidifiers, where the air is saturated and cooled to the wet bulb temperature, usually dropping the outside air temperature from 105° to between 70° and 75° purely by evaporative cooling. This air is blown through underground tunnels and discharged through adjustable outlets or nozzles directly on the men who are working at the rollers. The lowered temperature of the air together with the velocity was found to produce ample cooling to permit the men to work at maximum efficiency.

Greater emphasis needs to be placed on the benefits of air conditioning in increasing human efficiency and health in industry. To this end it is desirable that those supervising industrial sanitation should collect and make available more data in this field. This would not merely be a service in the interest of public welfare, but would lead to more efficient and lower cost of operation on the part of the manufacturer.

In order that the standards of air conditioning may be properly established, it is necessary to study the physiological and sensory reactions

Speed of production and appearance of product are improved by the control of humidity.

in relation to the air conditioning factors of temperature, humidity, and air motion.

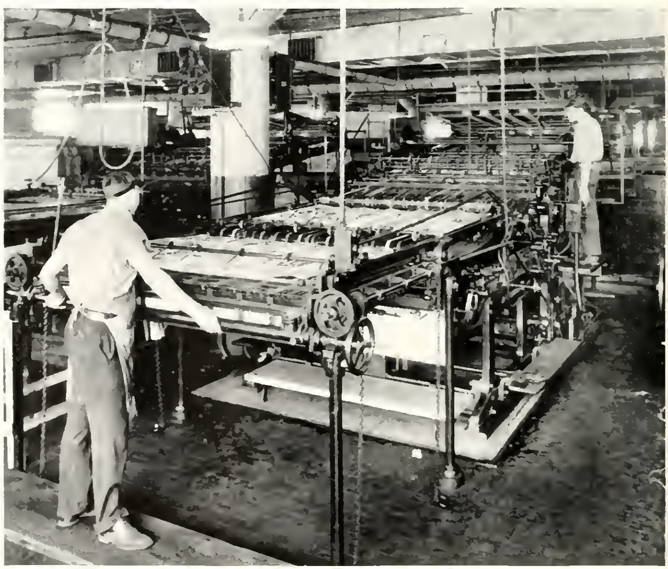
The determination of these effects on human efficiency depends largely on laboratory research, but this is supplemented by some actual statistics obtained in industry. The American Society of Heating and Ventilating Engineers in conjunction with the Bureau of Mines at Pittsburgh have made some very interesting studies on the effect of temperature, humidity, and air motion in relation to human comfort and human efficiency. These researches were begun in 1921. They resulted in the development of what is known as the "comfort chart" which indicates the variations of temperature, humidity, and air motion which give equal sensations of warmth. For practical reasons, these researches and the chart excluded the effect of radiation except as it naturally occurs to surroundings of the same temperature as that of the air, since this may be considered a normal condition. The effect of radiation in removing body heat is covered by the publication of December 1, 1928, by Dr. L. B. Aldrich of the Smithsonian Institute entitled "A Study of Body Radiation." Further research is needed to correlate unusual or artificial radiation effects with the other three factors affecting human comfort and sensation of warmth.

Some of the principal findings in these investigations are of considerable interest. The first important finding was, as might be expected, that humidity is an equally important element with temperature in effecting the sensation of warmth. Saturated air at 65° feels precisely as warm as air at 72° and 10% relative humidity, normal radiation effect included, while air at 80° saturated feels as hot as air at 100° with 10% relative humidity: a spread in dry bulb temperature in the first case of 7° and in the second case of 20°. These results were obtained with air motion of about 15 ft. per minute. Increased air motion greatly lowers the scale of temperature sensation. The lines of equal sensations of warmth for varying conditions are designated in terms of so-called "effective temperature." The effective temperature for the first illustration is 65°, and the effective temperature for the second illustration is 80°. Experiments were also made as to the variation in metabolism at different effective temperatures and also as to the relation between the total heat loss from the human body and effective temperature. These experiments showed that the heat loss from the human body between 65° effective temperature and 87° effective temperature was nearly constant when the subject was at rest and that the heat loss in this range was slightly under 400 B. T. U. per minute for the average person weighing 165 lbs. At effective temperatures lower than this range, the heat loss and the metabolism both increased to a marked degree while above 87° effective temperature, the heat loss from the human body dropped off nearly in a straight line while the metabolism or heat produced by the body *increased*. This is obviously the condition leading to a heat stroke where a balance can no longer be obtained between the heat produced and the heat removed. Since the increase in metabolism increases with muscular work performed, this point of balance occurs at a considerably lower temperature with a person working.

Heat is disposed from the human

(Turn to page 58)

Proper humidity simplifies difficulties due to static electricity in the printing industry.



ALUMNI AID IN DEVELOPMENT OF ARMOUR INSTITUTE OF TECHNOLOGY

by
J. Warren McCaffrey

THE officers of the Alumni Association had several meetings early this year with the Executive Committee of the Board of Trustees of Armour Institute of Technology for the purpose of evolving a financial program for the advancement of the Institute, both educationally and physically. As a result of these meetings a comprehensive study was made of Alumni relations existing between other colleges and universities and their respective Alumni groups with a view to bringing our Alumni and friends into closer relation to Armour Institute by joining in a definite constructive program. After several conferences such a program was agreed upon, which was patterned after similar plans in operation today, and improved upon by studying the experiences of many other colleges and universities throughout the country. Subsequently the program was submitted to the Board of Managers of the Alumni Association and was unanimously approved, and at a meeting of the Board of Managers on October 14, 1938, the resolutions necessary to put the financial program in operation were prepared and approved.

The financial program, which is herewith presented to the thousands of Alumni and friends of Armour Institute of Technology through the columns of the *Armour Engineer and Alumnus*, is completely and succinctly contained in the slogan AN ANNUAL GIFT FROM EVERY ALUMNUS. The underlying principle of the program is to inform the Alumni of Armour Institute of Technology about the latest developments at the school and plans for its advancement to its rightful position as the leading school of technology in the Central West, and at the same time to advise each and every alumnus how he may participate in a program designed to bring his Alma Mater to its justified position among institutions of its kind. This means contacting personally approximately 4,000 graduates and former students of Armour Institute of Technology for which purpose a committee has been appointed by the President of the Alumni Association, and approved by its Board of Managers, comprising approximately 150 men who have expressed themselves as willing to disseminate information about the plans for the Institute and to participate in the program designed to bring those plans to fruition.

Colleges and Universities throughout the country are receiving help in some form from their alumni. Even the state universities that receive large grants from taxes and federal gifts are also receiving enormous sums for special purposes from their alumni.

You participate yearly in charities such as religion, foreign missionaries, Y. M. C. A., and other worthy causes. Why not extend this privilege to do something for your Alma Mater that gave you many educational advantages through the generosity of others?

To win a war a nation must have loyal men and gold. To tell you why Armour Tech needs grateful, loyal alumni and gold is another story. For this purpose the writer has appointed, with the approval of your Board of Managers, a most able and loyal alumnus, namely, J. Warren McCaffrey.

JOHN J. SCHOMMER,
President Armour Institute Alumni Association.

The Executive Committee charged with the administration of the financial program is composed of the undersigned, as Chairman, and William F. Sims, Arthur Wagner, Ralph E. Friedman, John J. Schommer, Claude A. Knuepfer, Clinton E. Stryker, Harold A. Munday and Arthur H. Jens, as Vice-Chairman, and Fred B. Attwood as secretary. Each class from 1897 to 1938, inclusive, will be represented by a member who is in hearty approval of the program as outlined. All 42 class representatives have not been appointed at the time of this writing, so that a complete list of their names cannot be given in this issue of the *Armour Engineer and Alumnus*. Each class representative under the plan may appoint as many assistants as he deems advisable for the purpose of contacting every graduate and former student of Armour Institute of Technology. As a suggestion to the class representatives it is believed that assistants should be appointed in some workable ratio, such as one assistant for every five to ten classmates to be contacted. A complete list of the class representatives and all of their assistants with proper acknowledgments will appear in the next issue of the *Armour Engineer and Alumnus*.

There will be a general meeting of the entire committee early in November at which President H. T. Heald will outline the immediate objectives of the financial program to the entire personnel, numbering approximately 150, which is entrusted with the successful accomplishment of the plan. Suffice to say here that the Board of Managers of the Alumni Association have approved the allocation of any funds collected during the 1938-39 period of the financial program to the rehabilitation of the Armour Mission as a modern, completely equipped

students' union, which work is already nearing completion.

All graduates and former students of Armour Institute will be asked to participate in the financial accomplishment of each stage of the development of their Alma Mater by making a voluntary contribution each year of whatever amount they can afford and for whatever specific purpose they choose. Each year the Board of Managers of the Alumni Association will advise the Alumni of the several more important requirements in the development of the greater Armour Institute and will select the greatest and most important need each year. A contributor may accept the selection of the Board of Managers for any one year or may designate some other purpose for the application of his contribution; contributions, unless so designated by the donors, will not be deposited in the general fund of Armour Institute of Technology. The Board of Managers of the Alumni Association will have exclusive control over all funds received under this financial program until they have been spent for the purposes designated.

Marshalling an operating committee of approximately 150 former students of Armour Institute of Technology who are in hearty accord with the purpose and objectives of the financial program "AN ANNUAL GIFT FROM EVERY ALUMNUS" has been a difficult, but pleasant task by reason of the willingness and cooperative spirit of the entire personnel which was unmistakenly manifested to the writer in securing their acceptances to devote a portion of their time to the accomplishment of the plan and to participate themselves in the objectives sought. There is no doubt in the writer's mind that this manifested enthusiasm will be much greater upon President Heald's relation of what has been done, and what he hopes for Armour Institute of Technology, in which program all its former students and friends may participate in a substantial and enduring manner. It is believed that this intensified enthusiasm on the part of the 150 members of the committee can be translated in a very practical sense to a majority of the 4,000 graduates and former students of Armour Institute of Technology whereby they will manifest their interest in the future of their Alma Mater in a material way by participating in a voluntary program for the financial and educational advancement of the Institute. AN ANNUAL GIFT FROM EVERY ALUMNUS, regardless of the amount, and not obligatory in any sense, will accomplish the immediate objectives of the program.

There will be no campaign to raise funds, but there will be an earnest effort made on the part of the entire personnel of the committee in charge to see every living alumnus and former student with the object in view of informing them regarding some of the future plans of Armour Institute of Technology and asking them if they would care to participate in a program successfully to accomplish those plans. Although it is proposed to use a pledge card as a means for recording amounts promised and paid, it is hereby publicly proclaimed that any contribution or pledge will be in every sense of the word absolutely voluntary and not binding upon the donor, his family, or his estate.

May I close by asking the cooperation of all to the extent of being courteously attentive to any member of the committee who may call on you, and please bear in mind that he is not a collector, but a salesman of a financial program for the educational and physical advancement of your Alma Mater which afforded you an opportunity for a technical education second to none at less than cost.

Sincerely yours,
J. Warren McCaffrey.

WELCOME HOME
ALL GRADS AND FORMER STUDENTS
of
ARMOUR INSTITUTE of TECHNOLOGY

The faculty joins me in extending to each of you a very cordial welcome to attend our Annual Home Coming at the Institute, Friday afternoon and evening, December 9th.

During the afternoon, all departments of the Institute and Research Foundation will be operating on regular schedule, and you will have an excellent opportunity to see the changes and improvements which have been inaugurated.

Be sure to be on hand between five and six at the new STUDENT UNION to meet your old friends and all members of the Institute faculty and staff of the Research Foundation.

Dinner will be served in the student dining hall of the STUDENT UNION at six o'clock, after which you will have an opportunity to learn first hand about what is going on at Armour.

I know you will want to visit the Evening School after the dinner meeting and observe the fine service Armour is rendering a large group of ambitious men.

Genuine interest in your Alma Mater is earnestly solicited, and I look forward to greeting each of you on this occasion.

Cordially,
H. T. HEALD, President.

For reservations: Call or write Prof. D. P. Moreton, Alumni Office, Armour Institute of Technology, Chicago, Telephone Victory 4600 $1.00 per plate.

OUR STUDENT UNION

FOR a number of years the lack of adequate space has been, as it is today, a pressing problem. We have been growing by leaps and bounds, adding more and more members to our family, until now we can speak of a total enrollment in all divisions of over four thousand students. During many hours of the day and evening, there is not a single classroom available, and in order to accommodate the students who look to us for an education, we have had to come early and stay late and keep school every day in the week. Indeed, we have had to convert space originally intended for altogether different purposes into classrooms in which to accommodate an instructor and his students. It is worth noting in passing, however, that the instructor and the students have been happy to find a place in which to work together, taking little thought of actual physical environment. As a result, the Institute has won a reputation for honest work, performed amidst surroundings perhaps unattractive to the eye but inspiring to the soul.

With the demand for classrooms has come the problem of space for re-creational purposes. One by one the various student organizations have had to give up quarters or be tenanted together to release their space for actual educational requirements. More and more the need has grown for a room, a hall, a building which the students could call their own. It was not a place for play they wanted so much as a place for meeting their fellow men, for developing their personality, for exchanging ideas, for making friends, in an atmosphere and an environment conducive to comradeship. The student goes out into industry and meets his employer on the job, but perhaps, if the room were available, the employer would come to his school and see his young foreman or superintendent in the making.

The prospect of such a meeting place seemed dim or distant in view of the steady encroachments of classroom demand and the lack of endowment for erecting a suitable building. Perhaps many a student thought of a man who had made his own fine mark in the world who would gladly step forward and give such a building if only he knew where such a building was needed, what good he would be doing in giving it, and how many young men in the years to come would revere his memory.

But nothing daunted, the engineer made a reconnaissance. How utterly foolish it might have seemed to give such significance to something so utterly impossible. As if he didn't know we hadn't an empty or idle square foot in the whole school! And yet, the reconnaissance was made. There was no "Old Main" that had outlived its usefulness that could be converted into a student union. "Old Main" at Armour still hums with motors, reeks with fumes from the chemistry laboratories, offices the president and the deans, secures the registrar's records, spreads dust and learning from the books of the library, and thunders and blows from the mechanical laboratories.

But what about Old Mission! Built in 1886, the gift of Joseph F. Ar-

Exterior View of Student Union Building

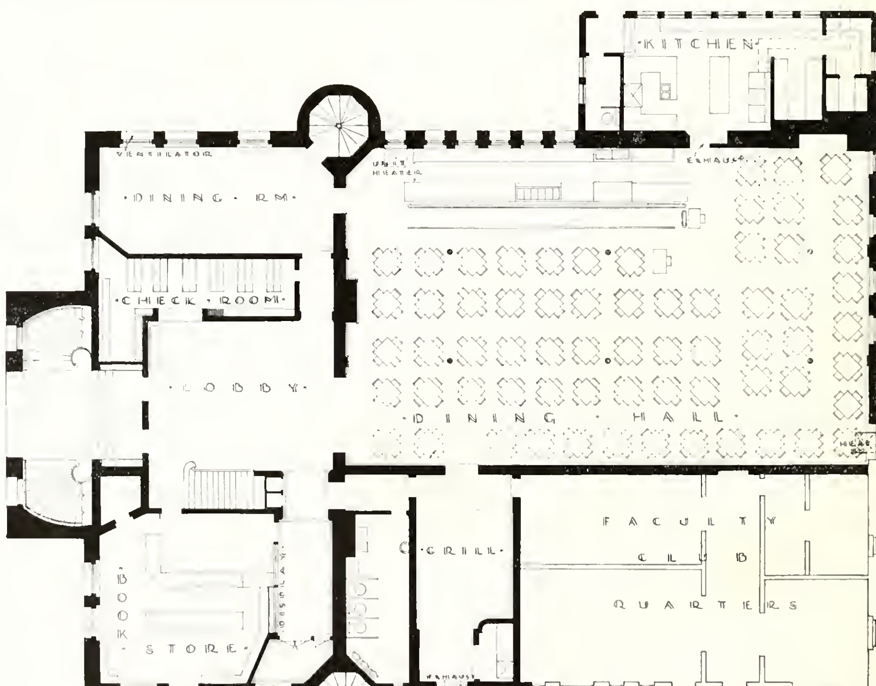
mour and his brother, Philip D. Armour, for the extension work of Plymouth Church as a human laboratory, it went through the cycles of youth and maturity and age, and finally gave up its original function and became merely a useful addition to the Institute. Its glory had faded and passed. And few are left who remember it when it was like a dynamo electrifying the life of the community, when thousands of children, large and small, of all races and creeds, flocked into its workshops and learned the lessons of usefulness and honor.

But now we may read how Philip D. Armour carefully tended his seed, watched it grow into a burning bush, and saw it flourishing finally as a flaming tree of light and life. The tree was Armour Institute of Technology and the Mission the seed.

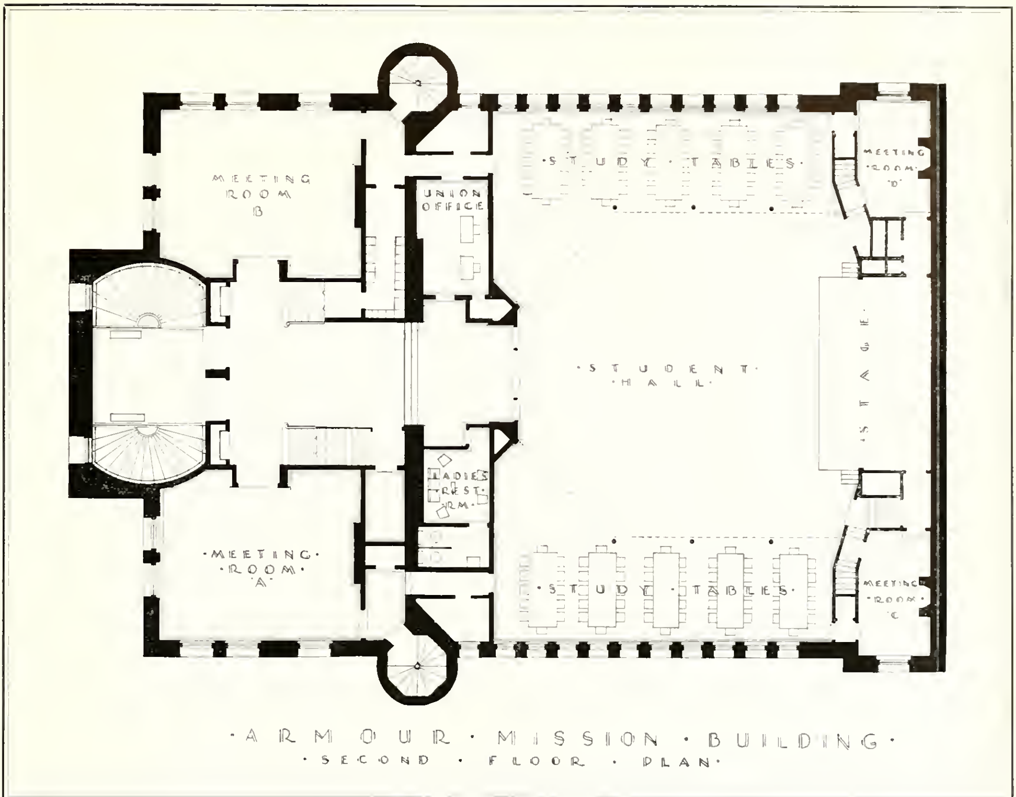
The Mission had been built for the perpetual re-creation of youth. Here and now, more than fifty years later, it will come to life again,—its foundations are still strong and its walls unshaken by time; and the things for which it stood, still valid in an uncertain world, a world of prejudice, of intolerance, of suspicion, and of hate; and what could be more fitting and just than the rededication of the building for the enrichment of the lives of young men!

A survey was made, and the project was found feasible. Students urged it, faculty encouraged it, administration assisted it. All were agreed on its desirability, and all were in complete accord. Tentative estimates of probable costs having been determined, the immediate problem was that of financing the project. A plan evolved by Professor David P. Moreton, who had given much time and thought to the problem, was approved by the Executive Committee of the Board of Trustees and unanimously accepted by the students. This plan provided for the issuance of \$40 000 worth of 4% Student Union income debentures, the payment of principal and interest to be made from dues collected from every student attending the Institute, these dues to be put into a Student Union Fund of which $62\frac{1}{2}\%$ is for principal and interest and the remainder, $37\frac{1}{2}\%$, for operation and maintenance. At this happy moment the Armour Institute Alumni Association stepped forward with the promise of a gift of \$10,000.

At a special meeting of the Board of Trustees the completed plan was finally approved and endorsed, and a Building Committee appointed, consisting of Professor Moreton and President H. T. Heald. The debentures were printed, and subscriptions amounting to \$30,000 taken. Loebl and Schlossman, graduates of the Institute, were engaged as architects to draw up definite plans, and R. S. Wiebeldt Company was awarded the general contract. N. Y. A. students as-



·ARMOUR · MISSION · BUILDING·
·FIRST · FLOOR · PLAN·



sisted in wrecking the interior preparatory to remodeling.

First Floor

The work has been completed! As we step across the threshold of the main entrance (Plan 1), we see no indications left of the old building. Everything has been transformed. We find ourselves in a spacious lobby, with an information desk and an up-to-date check room to the left. In the corner room beyond is a private dining room seating approximately forty people. To the right of the lobby is the school store, now turned around and having inside entrances, completely refurnished with new and striking equipment. In the entry way we find two telephone booths conveniently located. But the greatest of the improvements on the first floor is still in front of us. Swinging aside the doors, we step into a modern dining hall, seating 260 students. Everything is new throughout, from the chairs and tables and latest type cafeteria table to the ventilating system. Connected with the dining hall is an addition to the building, containing a kitchen with all the latest conveniences, including a new range, a broiler, power dish washer, vegetable preparation table, step-in refrigerator, and storage room. On the opposite side is the new faculty grill, finished in knotty pine and hung with colonial fixtures, giving it a very distinctive atmosphere. The new grill, seating 32 men, connects directly with the reading room of the faculty club. This fine improvement was made possible by a substantial gift from the club for this special purpose.

Second Floor

Ascending the inside stairway, we come to the second floor lobby. In all four corners of the building are meeting rooms for student organizations, with lockers conveniently located for their equipment. To the left of the lobby is the Union office, and to the right the ladies' rest room. But most impressive is the student hall, completely leveled and refloored, and with a rebuilt stage. Since there are no fixed chairs in this central hall it may be used for temporary exhibits and dances. For assemblies, chairs will be moved into the center. Under the balconies, large sturdy tables are arranged for studying. A plaster fixture has been built in as a part of the ceiling, providing direct and indirect lighting for the main auditorium.

Third Floor

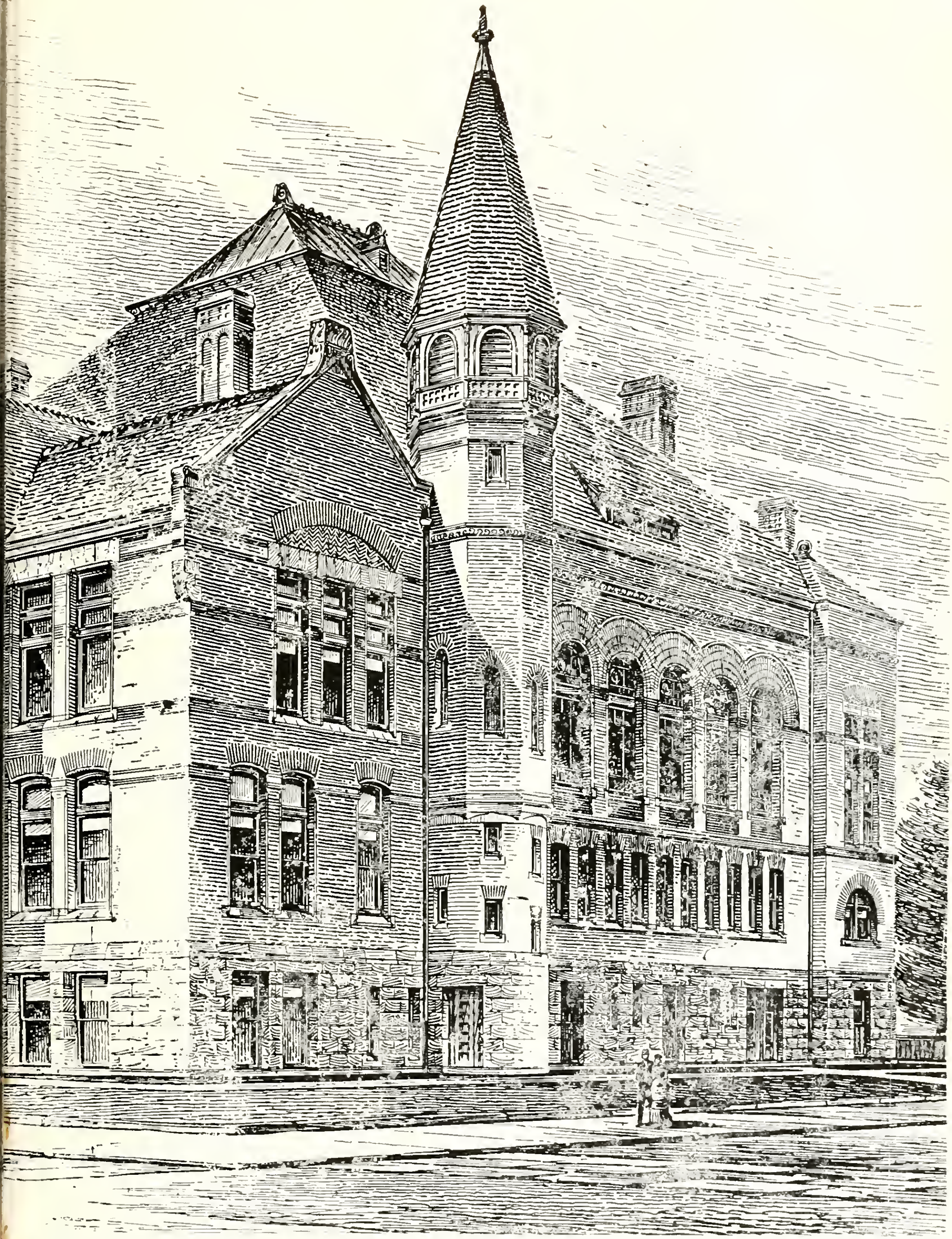
Many will remember the old civil drafting room, but they would hardly recognize it today as a student lounge, furnished with rugs, sofas, chairs, game tables, lamps, and drapes, and all harmoniously decorated. Here students will gather for a "bull session," or to read the current periodicals, or to match wits at cards, or checkers, or chess. From social contacts will come dignity and self assurance; and the students will gain from this human laboratory an education and training that cannot be gained otherwise than by association with one's fellow men.

It is in this way that the Old Mission will live again, now in the hearts of many generations of Armour men.

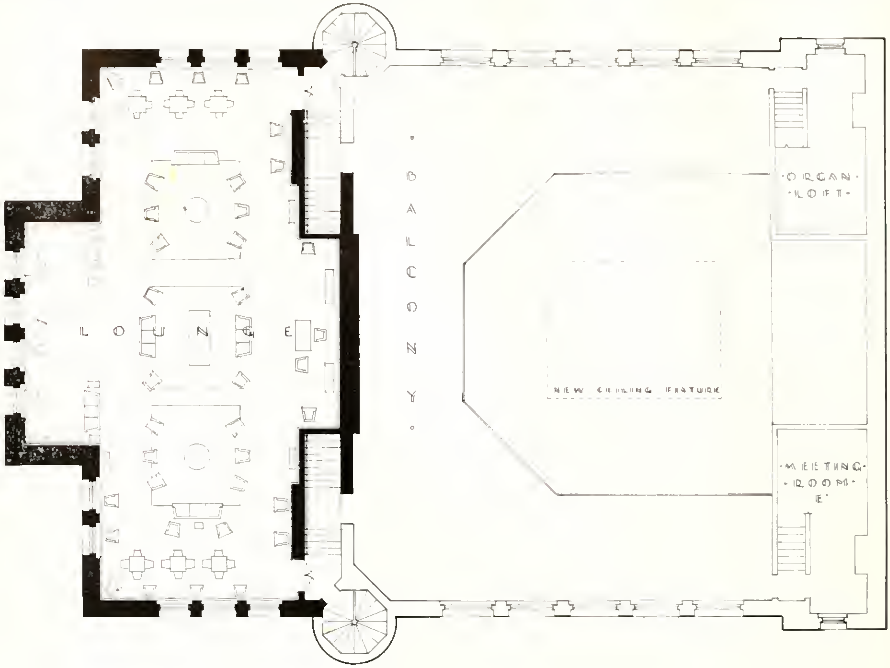
* * *

For sake of completeness, it has been thought well to include a number of particulars not already covered in the story above. These fall into

Old zinc etching showing Arm



sion as it appeared in 1886



• ARMOUR • MISSION • BUILDING •
• THIRD • FLOOR • PLAN •

several fields all thoroughly familiar to graduates of the Institute.

General Contractor

The general contract was awarded to R. C. Wieboldt Company of Chicago, who sublet all except the carpenter, mason, and cement work which they did themselves.

Materials were largely purchased from the Consumers Company of Chicago.

The satisfactory completion of a project of this kind is in no small measure due to the supervision of the general contractor in co-ordinating the work of all the building trades on the job.

Heating System

A thorough investigation of the existing heating system proved that it was not adequate and that the steam pipes and returns were unsightly. A new two-type gravity return system was installed, and particular attention was given to the location of the pipes so that they are not at all conspicuous at the present time. All return pipes are of copper and laid in tile, for mechanical protection, under the cement floor.

Exhaust steam for heating is supplied from the central power house across the street at about seven pounds pressure. Provision was made in the installation of the system for readily converting it from a gravity return to a two-pipe vacuum system should future requirements result in the necessity of such a change.

Hot water for the dishwasher and for the many other requirements is supplied from a large tank suspended on the ceiling of the kitchen. Water in this tank is heated by steam from the central plant and may be operated independently of the main heating system.

The heating system was installed by Gallaher and Speck, Inc., a firm which was established in Chicago in 1885 and enjoys a high reputation in the field of heating, ventilating, air conditioning, and power piping.

The Ventilation System

A new Ilg ventilation system has been installed in the Student Union Building. It will provide positive elimination of cooking odors and heat from the kitchen and dining room and prevent building up of musty dead air pockets in other rooms. The kitchen is ventilated by a B 40 Ilg direct-connected blower which exhausts 5,530 cubic feet of air every minute from a hood over the kitchen range. This blower runs at the slow speed of 570 R.P.M. An interesting feature is the mounting of the motor directly in the side of the blower house, eliminating the need of any separate motor pedestal. The blower wheel is mounted on the blower shaft so that no belts are required, and of course there are no problems of misalignment possible.

The main dining room is ventilated by a combination exhaust and supply system. The exhaust ventilation is provided by a 36" ML Ilg self-cooled motor propeller fan with an air moving capacity of 8300 cubic feet per minute. The construction consists of an open type Ilg fan motor which is covered by a metal hood and ventilated by a vent pipe extending to the outside, thus providing the operating economy of an open motor with the mechanical protection against dirt

(Turn to page 43)

NEW TRUSTEES

HAROLD S. ELLINGTON, president of the firm of Harley and Ellington, Architects and Engineers, of Detroit, Michigan, was nominated by the Armour Institute Alumni Association, in June, 1938, for the position of alumni representative on the Beard of Trustees, for a period of three years.

H. S. Ellington

Mr. Ellington graduated from Armour Institute of Technology, in civil engineering, in 1908, and started to work for the National Construction Company, railroad engineers. Within a short time he transferred to the Standard Concrete Construction Company, contractors specializing in reinforced concrete buildings and structures. From 1912 to 1916 he was plant engineer for the Stroh Brewery Company, Detroit; and from 1916 to 1919, construction manager for the Book Estate, Detroit. In 1919 he became a partner in the firm of Giaver, Dinkelberg, and Ellington, architects and engineers, and in 1923 a member of the firm of Weston and Ellington. Ten years later, in 1933, he became a member of the partnership of Harley and Ellington, which connection he has retained up to the present time.

He is a member of the Michigan Engineering Society and vice president of the Engineering Society of Detroit. He is also a member of the Advisory Board of the Michigan Housing Association.

CHARLES BEACH NOLTE, president and director of Crane Co., Chicago, since March, 1935, was born in Mattoon, Illinois, December 28, 1885.

After attending the public schools of Mattoon, Mr. Nolte matriculated at the University of Illinois where he graduated with the degree of Bachelor of Science in Mechanical Engineering in 1909. From May to October, 1909, Mr. Nolte was a mechanical engineer in the Engineering Experiment Station at the University of Illinois. He then joined the Robert W. Hunt Co., engineers, of Chicago.

C. B. Nolte

The connection with the Robert W. Hunt Co., was the beginning of a career which was to see Mr. Nolte rise successively from engineer (1909-1912), to manager (1912-1923), then vice president and general manager as well as a member of the Board of Directors (1923-1930), then president and general manager and member of the board of directors (1930-1935).

Mr. Nolte also is president and director of the Crane subsidiaries, including Crane Co. of Mexico, Crane, Ltd., Montreal, Crane Export Corp., Crane Enamelware Co., Canadian Potteries, Ltd., Warden-King, Ltd. He also is a director of Trenton Potteries Co., Trenton, N. J., another Crane subsidiary.

Organizations of which Mr. Nolte is a member are the American Society of Mechanical Engineers, American Society of Civil Engineers, American Society for Testing Materials, American Railway Engineering Association, Western Society of Engineers, Newcomen Society, Chicago Engineers Club, in addition to the Chicago Club, Union League Club, University Club and South Shore Country Club.

CHARLES LESLIE RICE, vice-president of the Western Electric Company in charge of its Hawthorne Works, was born in Pittsfield, Massachusetts, August 5, 1879.

He graduated from Massachusetts State College and Boston University in 1901. For a short time after graduation he engaged in contracting work in Pittsfield. Then, desiring to get into a more technical field, he joined

C. L. Rice

ANNUAL HOMECOMING

See Announcement on Page 28

the Western Electric Company in January, 1902, as a student at New York.

From January, 1902, to May, 1905, he worked in practically every shop department, learning the essentials of machine operation, set-up, and tool making. This period was an important one, providing him with a broad knowledge of telephone manufacturing processes to serve as a background for his later progress. Upon completion of this course he entered the equipment engineering organization. He next took up production work, and in 1907 became head of that department. His next promotion was to Assistant Superintendent of the New York shops, and in 1911 he went to England as Works Manager of the Company's former allied factory in London. At that time Western Electric was an international concern with factories and branches in many foreign countries.

He was recalled to the United States three years later to become Production Superintendent at the Hawthorne Works in Chicago, then, as now, the Company's principal manufacturing plant. In December, 1923, he became an Assistant Works Manager in charge of the clerical, production, and inspection branches, and on June 14, 1926, he was made Hawthorne Works Manager in charge of all the Company's manufacturing functions at the plant. On December 11, 1928, the Board of Directors elected him a Vice-President of the Company.

Mr. Rice served twice as President of the Chicago Association of Commerce. He is also Vice President of the LaGrange National Bank, a Director of the Cicero State Bank, and President of the LaGrange Park District Commission.

Throughout his business life, Mr. Rice has established a reputation for exceptional capacity for details, good judgment, and broad humanity. He was one of the first industrial leaders to recognize that safety in industry was more than mere guarding of machinery, and in five years his safety program based on the human element reduced accidents in the Hawthorne Works from 27.53 per million man hours exposure to approximately 2.00 per million man hours exposure in 1933—a reduction of 94 per cent.

Because of his outstanding leadership in safety work, he was called upon to serve as President of the Chicago Safety Council for a number of years during which the Council focused for the first time the attention of Chicago residents on the need for public safety education. As a citizen of LaGrange, Illinois, he was instrumental in organizing a campaign among auto drivers similar to the industrial campaigns in the Western Electric Hawthorne Works, which culminated in a National award for LaGrange as the safest community of its size in the United States. He was called upon to aid in Illinois' campaign for the drivers' license law and was a member of a State-wide committee to promote this movement.

Chicago considers Mr. Rice one of its foremost civic leaders. When Chicago became synonymous with crime in every country on the globe, he was made Chairman of the Coordinating Committee for the Prevention of Civic and Criminal Injustice—an organization that has done much to regain for Chicago her lost prestige. He was recently appointed by Governor Horner as a member of the State Housing Commission.

As a leader in Chicago industry he has served on many committees and boards in such organizations as the Illinois Manufacturers Association, the Chicago Association of Commerce, and the Union League Club of Chicago. He is also a member of the Western Society of Engineers, the LaGrange Country Club, and a number of fraternal organizations, including Alpha Sigma Phi.

HIGHLIGHTS OF THE PRESIDENT'S REPORT

THE annual report of the President, H. T. Heald, to the Board of Trustees, for the year ending August 31, 1938, has recently been published and distributed among the faculty, the alumni, and friends of the Institute. Because of the fact of its widespread distribution, there is no need to review this complete and comprehensive statement in any detail, but it may be worth while to call attention to its more significant sections, particularly for those who have not had the time or the opportunity of examining it closely.

For a matter of record the President notes the resignation of Dr. Willard E. Hotchkiss in October, 1937, and his own election in May, 1937. Then follows the announcement of the appointments of Dr. C. A. Tibbals as Dean of the Undergraduate College and of Professor H. P. Dutton as Dean of the Evening Division; of Professor D. P. Moreton as Director of Public Relations, and of Professor I. J. Schommer as Director of Placement; of Dr. B. B. Freud as Chairman of the Section of Chemistry; of Dr. Wm. A .Pearl as Director of Engineering Shops; of Professor Harold A. Vagtborg as Managing Director of the Research Foundation, and of Mr. William Setterberg as Registrar of the Evening Division.

Of very great interest and significance among the new appointments to the faculty are those of the distinguished Ludwig Mies van der Rohe as Director of the Department of Architecture; of Mr. Ludwig Hilberseimer, Professor of City Planning; of Mr. Walter Peterhans, Professor of Visual Training; and of Mr. John B. Rodgers, Assistant Professor of Architectural Design. The President remarks in this connection that "there is every reason to believe that this department will develop into an outstanding school of architecture and make a very significant contribution to architectural education in America."

Enrollment figures are always of interest to the alumnus. In respect to this he will find that during the year 1937-38 the enrollment in all divisions of the Institute reached the highest figure in its history; and he may consult the table summarizing the enrollment of the past five years.

The report proceeds with a summary of the Divisions.

In the Undergraduate College the curricula of the Chemical, Civil, Electrical, and Mechanical engineering options were approved by the Committee on Engineering Schools of the Engineers' Council for Professional Development; and Armour was the only school in the Chicago area that received this distinguished recognition.

The student personnel program covering admission, testing, and counseling has been greatly developed, and a Department of Educational Tests and Measurements, under Dr. W. C. Krathwohl, has been created.

Cooperative students are now well established at Armour, the first class starting its fourth year in February, 1939. Eighty-one companies are now participating in this plan.

The student aid program reached a total of $42 000, consisting of Fire Protection scholarships, freshman and senior scholarships, student assistantships, and $8,000 in Federal funds from the National Youth Administration.

The Evening Division, under the

(Turn to page 44)

MEET THE NEW FACULTY MEMBERS

MERRILL G. CHRISTOPHERSEN, writer and director of Armour's new radio series, brings to his present office of Instructor of English a background of wide and varied experience. He taught in several colleges and secondary schools; wrote a column of theater criticism for the *Rockford Journal;* edited a C. C. C. newspaper as educational adviser at Camp Skokie; and prepared and broadcast a series of dramatic sketches. He is also the author of several books.

Mr. Christophersen graduated from Beloit College in 1926. He attended the University of Wisconsin, Rockford College, the University of Iowa, and Northwestern, from the last of which he received the M. A. degree in 1937.

PATRICK JOHN FITZPATRICK will work on heat transfer problems for the Research Foundation, continuing the work in heat transfer that he has been doing at M.I.T. Mr. Fitz Patrick completed his undergraduate work at Notre Dame, majoring in chemical engineering and organic chemistry, and receiving his B.S. in '35. He then went to M.I.T. for graduate study, remaining there until 1937. His advanced study has been in the fields of chemical engineering, heat transfer, and furnace design, and has included an investigation of "Dropwise Condensation of Steam on Tall Tubes," which is being submitted as a thesis for his Master's degree.

Mr. Fitz Patrick is a member of the American Chemical Society and the Western Society of Engineers.

LUDWIG HILBERSEIMER was born in Karlsruhe, Germany, and studied architecture at the institute of technology there. He later established himself as an architect in Berlin and became one of the leading theorists in the field of city-planning. Professor Hilberseimer soon began to write extensively on the subject of modern architecture, his published works including *Internationale Neue Baukunst*, *Grosstadt Architekur*, *Beton als Gestalter*, and *Hallenbauten*, the latter a work written for the series *Das Handbuch der Architekur*. He has extended his ideas on the subject of city-planning in a work just completed.

In 1928 he was appointed Professor of City Planning at the Bauhaus in Dessau, where he founded the department, and now he will continue in the same capacity as Professor of City Planning at the School of Architecture of Armour.

JOHN MARSH HOWE, formerly of Stevens Institute of Technology, has been appointed Director of the new Human Engineering Laboratory, located in the Glessner building on Prairie avenue at Eighteenth street. Mr. Howe received his B. S. degree from Dartmouth in 1935 and then did graduate work as a psychometrist under the well-known Johnson O'Connor from 1936-1937. He obtained much of his experience in "human engineering" through his association with Stevens Institute as an aptitude test instructor. Now, as Director of our laboratory, Mr. Howe is continuing this type of work, assisting college men and men in business in the determination of their vocations.

HOWARD MAXWELL KINDSVATER comes to Armour as Chemist for the Research Foundation and Instructor in Chemistry and Research. He graduated from Kansas State College in 1935 and then attended Iowa State University, receiving the M.S. degree in 1936 and the Ph.D. in '38. In his undergraduate work Mr. Kindsvater majored in industrial chemistry, mathematics, and physics; but for his graduate study he specialized in physical and organic chemistry, writing his theses on the diffusion of electrolytes.

Dr. Kindsvater is a member of Phi Lambda Upsilon, Alpha Chi Sigma, and the American Chemical Society.

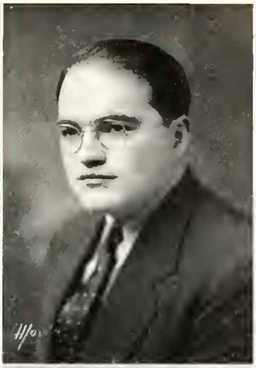
HALDON ARTHUR LEEDY has been appointed head of the Division of Sound of the Research Foundation. Graduating from North Central College in 1933, Mr. Leedy entered the University of Iowa, where he received his M.A. and Ph.D. degrees. His doctor's thesis, "Theoretical and Experimental Investigation of Reverberation," has been followed by the publication of other articles on the same subject. One article, "The Impedance Method of Calculation of Sound Absorption of Vibrating Plates," is soon to be published in the *Journal of the Acoustical Society of America*.

Mr. Leedy is a member of the American Physical Society and of Sigma Xi.

ALBION BAYARD LEWIS, newly appointed assistant to the President, comes to Armour with over thirty years of experience in school administration. Mr. Lewis attended school in the East, receiving a B. S. from Bates College in 1906 and later studying at Harvard, Teacher's College in New York City, and at Columbia University. During his graduate study Mr. Lewis specialized in mathematics and education and was awarded his M. A. degree from Columbia University in 1913 for work in mathematics.

From 1908 to 1914 he served as assistant headmaster of the Staten Island Academy in New York City. For the next five years he occupied a similar position in the Country Day School in Kansas City, Mo. From Kansas City he went to Lake Geneva, Wis., as headmaster of the Northwestern Naval and Military Academy, remaining there as headmaster for a period of nineteen years, until he became associated with Armour this year.

SANFORD BROWN MEECH, the newest member of the Department of Language and Literature, is an authority on Middle English literature and has written many articles





M. G. Christophersen | **P. J. Fitzpatrick** | **Ludwig Hilberseimer** | **J. M. Howe**

H. M. Kindsvater | **H. A. Leedy** | **A. B. Lewis** | **S. B. Meech**

in this field. Mr. Meech, a New Englander, attended Yale from 1920 to 1924. Majoring in English, he received his B. A. in '24, then left to teach, returning in 1927 for further work and receiving his Ph. D. in '29. He has also attended the Linguistic Institute at the College of the City of New York and at the University of Michigan. Mr. Meech has been teaching since 1929, first at Allegheny College, later at Hunter College, and then at the University of Michigan, which he left in 1938 to come to Armour.

While at Michigan he was one of the assistant editors of the Middle English Dictionary. He is now editing, for the Early English Text Society, *The Book of Margery Kempe*, a biography of a 15th century English mystic; and he is collaborating on an anthology of Middle English literature. In addition to these volumes he has published numerous articles on the results of his work in the Middle English field. He is a member of Phi Beta Kappa, the Middle English Group of the Modern Language Association, the Philological Society of England, and the Medieval Academy of America.

DR. JOHN L. MILLER, associate professor of metallurgy, comes to Armour from Babcock and Wilson Co. of Baberton, Ohio, with whom he has been associated as Research Metallurgist since 1932. He received his undergraduate training at De Paul University in Chicago and then worked four years as research chemist and metallurgist with the American Sheet and Tin Plate Co. in Pittsburgh, during which time he attended courses in chemistry and metallurgy at Carnegie Institute of Technology. From Carnegie Tech Mr. Miller went to the Engineering School of Harvard University, where he received his M. S. degree in metallurgy in 1930 and his D.Sc. degree in 1932.

He has published many research articles concerning, primarily, the properties, fabrication, and constitution of ferrous alloys.

The scope of the architectural department has been widened by the addition of WALTER PETERHANS as Professor of Visual Training. Professor Peterhans, internationally known for his work in photography, studied at the Universities of Munich and Göttingen and at the Academy in Leipzig. Because of his outstanding work in the field of photography, he was called to the Bauhaus in Dessau to create and direct its department of photography. Here he engaged in visual studies in which he investigated the structure and surface of materials and their mutual relationship. He developed photography to such technical perfection that it could be used to reproduce and make apparent the qualities and defects of materials. Professor Peterhans hereby created a new educational technique to sharpen the powers of observation and to reveal objectively the relationships between materials, structure, and space.








J. L. Miller — W. Peterhans — M. B. Reed — Hans Reissner

J. B. Rodgers — W. M. Simpson — L. Mies van der Rohe — W. L. Wasley

Experienced in the teaching of courses to students of electrical engineering, DR. MYRIL B. REED, new assistant professor, is a valuable acquisition to the electrical department. He received his undergraduate training at the University of Colorado, and his postgraduate instruction at the University of Texas, from which he received his Master's degree in 1931 and the Ph.D. degree in Physics in 1935, his doctor's thesis being on the subject of three phase metering. He studied at the Electronics Institute at the University of Michigan in the summer of '37, and has spent considerable time in electrical engineering field work with such companies as the Public Service Co. of Colorado, The Utah Power and Light Co., and the Westinghouse Electric Co.

Dr. Reed is the author of several books on electrical engineering. He is a member of Tau Beta Pi, Eta Kappa Nu, and the A.I.E.E.

Widely known for his work in aeronautics and mechanics, DR. HANS REISSNER has been appointed Research Professor of Engineering in the Graduate Division, after many years of experience as a teacher, consultant, and practicing engineer.

Awarded the civil engineering degree in 1897 by the Technische Hochschule, Charlott, Berlin, Dr. Reissner next attended the University of Berlin to receive the degree of Doctor of Engineering, in 1904. Until 1936 he was a professor of engineering in Germany, first at Aix la Chapelle, for a period of six years, then in Berlin.

His work is chiefly centered on steel and concrete construction and airplane design, at present being especially concerned with controllable pitch airplane propellors and the theory connected with it. His professional interest is carried over to outside activity, high powered boats occupying his spare time, together with water sports, swimming, and rowing.

JOHN B. RODGERS, recently added to the architectural staff as Assistant Professor of Architectural Design, graduated from Princeton University in 1926. He received the de gree of Master of Fine Arts in Archi tecture from Princeton in 1928, an completed his architectural educatio at the Bauhaus in Germany. He ha been associated with the firms of Ble and Lyman, York and Sawyer, an Edward B. Green and Sons. At pres ent he is a member of the firm o Rodgers and Priestley, Associates.

WILLIAM McCRAY SIMPSON a native of Oklahoma, graduated fro the state university in 1936, followin which he attended Texas A. & M. Uni versity, receiving his master's degr in 1937. He was recently appointe instructor in the Civil Engineerin Department after spending one yea as an assistant.

His graduate work has consisted the study of structures, air conditio ing, and water power, his thesis bein "The Effect of Joint Slip on Secon ary Stress."

Mr. Simpson is a member of Pl Eta Sigma, Tau Beta Pi, Pi N Epsilon, and Sigma Xi.

LUDWIG MIES VAN DER ROHE is probably the most widely known of all the new members of Armour's faculty, having achieved world wide renown as the European creator of modern architecture. Mr. van der Rohe was born in Aix-la-Chapelle of an old family of stone masons. He started his architectural career in Berlin where he became associated with Peter Behrens, whose pioneer work gave impetus to the growth of contemporary architecture. He represented Behrens in Leningrad during the building of the German Embassy there. Mr. van der Rohe's experience was further enriched by an extended sojourn in Holland where he made the acquaintance of Berlage, who brought to his attention the work of Frank Lloyd Wright.

In view of Mies van der Rohe's prestige in the architectural field, it was fitting that the German Workbund, whose director he later became, should entrust to him the execution of the Weissenhof Siedlung in Stuttgart. He invited many internationally known architects to carry out, in the exposition, their ideas of modern housing. Their combined efforts made the Siedlung the greatest demonstration of modern architecture which has ever been attempted in Europe. The Weissenhof project made Mies van der Rohe so widely known that in 1929 the German government retained him as architect for the German exhibition in the World's Fair at Barcelona. In 1930 he assumed the directorship of the world famous Bauhaus in Dessau. And now he has come to America to head our school of architecture.

WILLIAM LINGEL WASLEY, a native of Chicago, is one of the new members of the Chemistry Section of the Department of Chemical Engineering. Completing his undergraduate study at the University of Chicago in 1935, Mr. Wasley entered Louisiana State University for his M. S. degree, and then transferred to Stanford University, where he was awarded his Ph. D. in June of the present year. Organic chemistry has constituted his major graduate work, both his master's and doctor's theses, being concerned with the preparation of organic compounds.

Mr. Wasley is a member of Sigma Xi and of the American Chemical Society.

Hard work is the best investment a man can make.—C. M. Schwab.

HELP, HELP, HELP

PLACEMENT OFFICE

ARMOUR TECH

John J. Schommer

YOU have seen this caption in dear old Harvey Woodruff's column, "In the Wake of the News" in the *Chicago Tribune*, many a morning while you were at Armour Tech. The column was kept alive and spicy by the contributors, as it is now kept under the able direction of Arch Ward.

What has this to do with you? Just this, my dear alumnus: the writer, since October, 1937, has been investigating the various placement bureaus in industries and universities, and, in September, 1938, was appointed director of placement by President Henry T. Heald, with the authorization of the Executive committee of the Board of Trustees of Armour Institute of Technology. He needs your help as sorely as the "Wake of the News" needs the help of its contributors.

How can you help? Send in the name of industries hiring technical employees. Keep your data sheet in the placement office up to date. Perhaps the job you are looking for is looking for you. The more detailed information we have about you, the less time it will take for you to be selected for the position about which you have had the most experience and can best fill. If you have not made out a data sheet recently, come into the placement office and fill one out, or make a request for one and it will be promptly mailed to you. Don't overlook answering all of the questions—questionnaires may look like just so much red tape, but we need to have those questions fully answered so that we may put you in your proper classification.

It is the purpose of this placement department, with the aid of your professors, to make it the "clearing house" for employers and positions. The department will have ample office space, files, and a secretary at your service.

Industries throughout the United States will be cultivated to place Armour engineers. Part-time jobs for undergraduates working their way through college, temporary jobs, and permanent ones are all desirable. If you hear of one let us know.

Those desiring a change, or those seeking better jobs, will have their records kept on file. It is needless to say your records will be kept confidential. Our records for engineers desiring jobs and executive positions of responsibility paying \$4,000 a year and up are wholly inadequate. Employers seeking men for positions of responsibility usually scrutinize the available records of men for experience and college training and then ask for an interview. Please do your part. Keep your data sheets in the placement office up to date.

The placement department telephone, Victory 4600, 3300 Federal Street, Chicago, Illinois, is at your service from 8:30 A. M. to 5:00 P. M. every day, Saturday until 12:00 noon.

JOHN J. SCHOMMER,
Director of Placement.

DUTTON APPOINTED DEAN OF THE EVENING SCHOOL

H. P. Dutton

PUBLIC announcement was recently made by the President of Armour Institute of Technology, H. T. Heald, of the appointment of HENRY P. DUTTON, Professor of Business Management and Chairman of the Department of Social Science, as Dean of the Evening Division of the Institute. Dean Dutton succeeds Dr. B. B. Freud, who resigned from the position last spring to become Chairman of the Section of Chemistry.

Mr. Dutton attended Hope College at Holland, Michigan, and the University of Michigan, graduating from the latter in 1914 with the degree of B. E. E. From this date until 1937 he was connected with Northwestern University, holding positions from that of Instructor to Professor of Industrial Management. In 1933 he came to Armour, first as a lecturer, later becoming professor, and finally chairman of his department. During all these years Mr. Dutton has maintained a consulting practice in business management.

He is the author of several books and numerous articles on the subject of factory management and business organization. He is a member of the A. S. M. E., American Management Assn., Institute of Management, W. S. E., and American Economists Associations and a director of the Society for the Advancement of Management.

Dean Dutton assumes the duties of his new office with the best wishes of the student body, faculty, and alumni.

LIBRARY IMPROVEMENTS

MODERNIZATION of the library, an essential feature of the school's extensive remodeling program, is now nearing completion. The wooden stacks familiar to all since the opening of the library in 1893 have been replaced by steel stacks fourteen feet high, a change virtually doubling the capacity of the library while allowing greater space for the reading room. The increased capacity, it is hoped, will permit the transfer to the library of all volumes now housed in the annex, thus facilitating the library's service to the student body.

The new shelves, which were designed, made, and installed by the Library Bureau of Remington Rand, Inc., consist of two tiers. A balcony floored with thick glass plates provides easy access to the upper shelves. The lighting is of the type designed by the Department of the Interior and installed in the new stacks of the Congressional Library.

Reinforcement of the floor of the library, a measure necessitated by the huge weight of the 50,000 volumes and steel cases — over 125 tons — was accomplished by placing steel girders and columns in the basement. The work was done by E. H. Marhoefer Jr. Co. Mr. Marhoefer is a graduate of Armour, Civil Engineer, class of '26.

The Alumni office has just received the sad news that Lester T. Wilson, graduate in Chemical Engineering, 1914, suddenly passed away on Friday, November 4th, 1938. Mr. Wilson was held in high esteem by the Armour Institute Alumni Association and his alma mater. We extend to his family our deepest sympathy and mourn the loss of a sterling friend and benefactor. Mr. Wilson was sales manager of the National Lead Company, New York.

Lester T. Wilson

STUDENT UNION

(From page 34)

and other foreign material offered by the ordinary fully enclosed motor.

The dining room air supply system includes two 25/D6 Ilg unit heaters which consist of copper heating coils and self-cooled motor propeller fans. These unit heaters draw in air from the outside and temper it, discharging it into the room to replace that exhausted by the exhaust system. The units are connected to the central steam heating system and are equipped with thermostats, pressurestats, and automatically controlled dampers to regulate the proportions of fresh and recirculated air.

Two additional 16" S fans are used in two smaller dining rooms in the building. The student's office, checkroom, and toilets are ventilated by two B/21 Ilg direct-connected volume blowers, each having a capacity of 1380 cubic feet of air per minute.

The ventilating equipment was supplied by the Ilg Electric Ventilating Company, and installed by the Western Ventilating and Engineering Company, both of Chicago.

Electrical Power Supply

The building has been completely rewired, and because of the increase in load resulting from modern lighting requirements it was necessary to supplant the power supplied from the local generating plant by the installation of service from the Commonwealth Edison Company.

The lighting on the entire first floor and the floor and baseboard outlets in the lounge on the third floor are on a three-wire system connected to the Edison Company lines. All other lights are on what is known as a convertible three-wire system and now connected to the 110 volt local direct current supply. With this convertible three-wire system, it will be possible at any time easily to change from 110 volt two-wire supply to a standard three-wire supply.

A three-phase power supply from the Edison Company is provided to take care of the motors driving the ventilating fans and blowers and refrigerating machines.

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PRESIDENT'S REPORT

(From page 37)

direction of Dr. B. B. Freud, enjoyed the greatest year in its history. During the year every available class room was in use for evening classes.

Three nonresident classes in metallurgy were given in cooperation with the American Steel and Wire Company, in Waukegan, Illinois.

In the Graduate Division, the growth of graduate enrollment has been startling. For three successive years the rate of increase has been nearly 100% annually. This rapid growth indicates the accumulated demand for advanced study that has developed in the Chicago area.

For the first time a separate catalog of the Graduate Division was published; and the Division has undertaken to establish a publication outlet for the results of research of the Armour faculty.

The Public Activities of the Institute included a Power Conference in cooperation with engineering schools in Illinois, Indiana, Iowa, Michigan, and Wisconsin; a Conference for Industrial Executives; a Survey of In-service Training for the Chicago Association of Commerce; a Conference on Welding Design and Practice; and a final Conference on Structural Practice. A dinner commemorating the award of the Congressional Medal to Dr. Thomas C. Poulter was held; weekly radio programs were given throughout the year; the *Armour Engineer and Alumnus* reached a circulation of over 20,000 copies; and general newspaper publicity increased many fold.

The Institute was the grateful recipient of two pieces of property: the one, the Glessner House, designed by the eminent American architect, Henry Hobson Richardson, located at Prairie avenue and Eighteenth street and given by Mrs. Frances G. Lee and other heirs of John Jacob Glessner; and the other piece, a piece of vacant property on Michigan avenue, given by Mr. S. B. Chapin.

Substantial remodeling has been done on several of the buildings, and a new boiler was installed in the power plant. The library has been completely equipped with modern, double-decked, steel stacks and improved lighting; and several of the departments have added considerable new equipment.

Old Armour Mission has been transformed into a Student Union, providing more adequate facilities for recreation and comfort.

A placement service is maintained at the Institute to encourage contacts between prospective employers and students and alumni.

The total income from all sources, exclusive of the Research Foundation, was $546,779, compared with total expenditures of $526,726.

Four new members were elected to the Board of Trustees: Mr. Raymond J. Koch, '13, President of Felt and Tarrant Manufacturing Co.; Mr. Wm. T. Morris, President of the American Chain and Cable Co.; Mr. Chas. H. Strawbridge, President of Goodman Manufacturing Co.; and Mr. Bernard L. McNulty, President of Marblehead Lime Co.

At the May meeting the by-laws were amended to provide for the election to the Board of Trustees of an alumnus each year on nomination of the Alumni Association. Mr. Harold S. Ellington, '08, founder of Harley and Ellington, was elected by the alumni.

Special mention is made of the generous and whole-hearted assistance of trustees Cunningham, Alschuler, Eustice, Hammond, Koch, McNulty, Peabody, Wishnick, Cooper, Farr, Sanger, and Mitchell; and particular recognition is given to Mr. S. B. Chapin and Mrs. J. Ogden Armour for their continued help and encouragement.

Attached to the President's Report is the Second Annual Report of the Research Foundation, submitted by Professor Harold Vagtborg, the Managing Director.

ATHLETICS

THE beginning of the '38-'39 college year brings to light once more the many forms of competition engaged in by the Techawk athletes. Athletic Director, John Schommer, reports that all of the coaches are back this year: Root for track, Stenger for basketball and baseball, Weissman for boxing and wrestling, Bibb for golf, Colvert in charge of tennis, and McGillivray for the swimmers. In addition to these intercollegiate sports there will be touch football, and next spring the softball tourney.

The touchball tournament, with teams representing each department, is now in full swing. The seniors of the chemical department, last year's champions, officially opened the competition. In case there are any who persist in the one-popular but mistaken notion that touch football is a "sissy" game, it might be well to mention that the number of injuries in last year's tourney and in similar tournaments in other schools has caused Mr. Schommer to adjust the rules in order that the game may be faster and at the same time safer. This year's competition will feature a more open style of play, with such changes as will, it is hoped, eliminate all injuries.

The wrestling and boxing teams, under the guidance of Coach Weissman, are at present a bit cramped for workout space, but this will be remedied and work will be in full swing as soon as the new Student Union is ready to house the cafeteria. There are several vacancies in the team since the departure of last year's seniors, but these should be well filled by new men. The wrestlers are out to better last season's record of seven wins against three defeats. The boxing team had one win to balance their one defeat. The boxers spent much time preparing for the Golden Gloves Tournament.

Basketball, with Grant Stenger directing, will soon get underway. With the graduation of the "fighting Irish" co-captains, O'Brien and O'Connell of last year, Stenger will have two important spots to fill in. However, he has a well-balanced and fairly well experienced group of men from last year, with Henriksen and Swanson as co-captains, and the team will be out pointing toward a record higher than last year's four wins against ten defeats.

Coach Norm Root will again take charge of the Techawk trackmen and will be out after a record even better than the nine wins and three defeats of last season. He will have to rely on last year's regulars and try to find some new talent to fill in the spots held by last year's seniors. Practice will begin about the first of December with workouts in the University of Chicago's Fieldhouse. The interclass track meet in January will start the competitive season.

The swimming team has already started its practice at Bartlett Gym with Coach McGillivray at the helm. Most of last year's men are back, and the swimmers, like the other teams, have high hopes for a successful year. Golf, tennis, and baseball are still far in the future, but will soon come into their own prominence.

Research Foundation Progress

THE second year of operation of the Research Foundation of Armour Institute of Technology ended August 31, 1938. During these two years the Foundation has gradually added to its staff and extended its facilities until at the present time there are thirty scientists and assistants working in Foundation laboratories, comprising a floor space of approximately twenty-thousand square feet. These laboratories have been constructed by rehabilitating space originally used for other purposes. At the present time several new laboratories are being completed, including an X-ray Laboratory for penetration and diffraction investigations in both organic and inorganic materials, a Spectroscopy Laboratory and an Electrical Laboratory.

During the first two years of operation the Foundation served a total of two hundred and eighty-seven different companies, associations of manufacturers and individuals. Approximately fifty per cent of these have had several investigations made during the period and one company has averaged over one hundred per year.

The activities of the Foundation are separated into two divisions to permit the broadest use of its facilities by both large and small organizations. The Industrial Research Division, which produces approximately two-thirds of the gross income, undertook fifty-two long-term projects during the two-year period, many of them relating to problems which have long baffled industry. These projects are for both small and large organizations and several are for nationally known corporations, each of which use a research staff of over one hundred people.

The Experimental Engineering Division enables the use of the facilities of the Foundation for short-term investigations, generally of a special testing nature, through the services of the following ten general laboratories: Automotive, Chemical, Combustion, Electrical, Heat Insulation, Materials Testing, Metallurgical, Mechanical, Physics, and Vibration and Acoustics.

All projects in the Industrial Research Division are guided by an advisory committee which includes sponsor representation. The field of investigation embraced by an industrial research project is reserved exclusively for the benefit of the sponsor for the duration of the project. Agreements covering industrial research projects provide for patent rights, monthly and final reports, and the execution of the investigation and treatment of findings in strict confidence.

New equipment is being added to the facilities of the Foundation as required. During the past few months a number of items have been added, including the following: a small eleven hundred pound per square inch boiler, a coal pulverizer, heat drying equipment, refrigeration equipment for use

in connection with the large cold room in the Insulation Laboratory, a motor generator set, a sound level meter, a wave analyzer, a new electrical control panel and general equipment for the Electrical Laboratory, and extensive equipment for the X-ray Laboratory.

At a regular meeting of the Board of Directors of the Foundation on June 3, General T. S. Hammond was elected Director and President, and Mr. Bernard L. McNulty and Mr. Raymond J. Koch were elected directors. At the same meeting the offices of Director of Research and Managing Director were created and Dr. T. C. Poulter and Mr. Harold Vagtborg were elected to these offices respectively.

Before the first of December the Foundation will mail an abstract of the second annual report to all of the alumni of Armour Institute of Technology of known address, which will give further details of the growing importance of the Foundation to the Institute and to the community.

HAROLD VAGTBORG,
Managing Director.

STUDENT UNION

(From page 43)

An emergency service is also provided to take care of the emergency lighting throughout the building, which is controlled from a glass-covered switch box with locked door located in the wall of the north entry.

All electrical work throughout the building was handled by the Hoffman Electric Company of Chicago.

Lighting

Particular attention was given to the illumination problem and the choice of fixtures for the various rooms and halls. A rather unusual treatment on the ceiling of the student hall in the form of a large metal and plaster fixture resulted in a very flexible, pleasing and practical means of lighting this hall. This fixture was built by the Ruffing Plastering Company in accordance with detailed plans supplied by the architect. This same company did all the new and patching plastering work throughout the building.

Electrical equipment throughout the building was supplied by the Triangle Electric Company, the Solar Light Company, the Curtis Company, and the Commonwealth Edison Company, all of Chicago.

Roof

A new roof was put on the entire building, and a composition shingle, manufactured by the Leon Company of Chicago was used. All roof gutters around the building were relined, and new down spouts provided.

Plumbing

All plumbing and plumbing fixtures in the kitchen, dining room, and rest rooms, were installed by Charles E. Gawne, plumbing contractor, of Chicago.

Decorating

The color scheme used throughout is an off cream on the ceiling and a grayish brown on the walls, with darker dado. The J. M. Eckert Company of Chicago did all of the decorating work, using supplies furnished by the Armstrong Paint and Varnish Works, of Chicago.

Refrigeration

Refrigeration for the cafeteria counter, drinking fountain and the Daemicke Company step-in ice box is supplied from a General Electric refrigerating unit located on the floor in the storeroom of the kitchen.

Cafeteria and Kitchen Equipment

The latest ideas in food service and preparation equipment have been incorporated in the new dining room. The equipment has been constructed and furnished by The Stearnes Company who specialize in heavy duty equipment of this nature for colleges, dormitories, etc.

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LAST CALL FOR MISSING MEN

Help the Alumni office locate these men. Look over the list and send any information you can supply to D. P. Moreton, Alumni office, at Armour Institute of Technology, Chicago. Your assistance in this way will be a great help in completing the Alumni Directory:

1897
Salamson, Max, E. E.

1898
Weinsheimer,W.E.,E.E.

1899
de Rimanoczy, B., E.E. Morse, C. S., E. E.

1900
Campbell, Mrs. M., C.E. Graff, H. W., E. E.
Martin, Robt. C., E. E.

1901
Arnold, M. H., E. E. Baker, E. H., M. E.

1902
Baird, M. F., E. E. Miller, Ivan D., C. E.
Harwood, E. T., E. E. Scheidler, O., M. E.
Wallace, E. L., E. E.

1903
Kaempfer, A., E. E. Stillson, H. G., E. E.
Quien, E. L., Ch. E. Weisskopf, M. J., C. E.

1904
Knapp, M. J., E. E.

1905
Ash, Howard J., E. E. Stem, Le V. H., Ch. E.
Beamer, B. E., E. E. Thompson, J. K., Ch.E.
Brackett, John C., E.E. Tyler, Alva W., E. E.
Wright, M. E., E. E.

1906
Allyn, A. J., E. E. Gaylor, W. S., M. E.
Cutler, Ed. W., E. E. Kukawski, E. S., Arch.
Edson, N. L., M. E. Morrison, R. D., M. E.
Scott, P. J., M. E.

1907
Badger, L. H., C. E. Turnbull, Ira J., M. E.
Heinsen, Geo. M., C. E. Wheeler, H. M., E. E.
Kilgore, C. E., M. E. Wolfe, Edw. J., E. E.
Pratt, E. A., C. E. Young, L. B., C. E.

1908
Cahan, James, C. E. Loofbourrow, J.D.,M.E.
Collins, F. C., E. E. Morey, C. R., E. E.
Cornwell, A. B., E. E. Souther, S. A., E. E.
Latta, Smith H., M. E. Wolters, Geo., Arch.

1909
Ahern, J. F., F. P. E. Perrine, A. A., E. E.
Soper, E. C., M. E.

1910
Crocker, A.H.Jr., M.E. MacEwing, E. D., E. E.
Gentry, T. E., M. E. Pearce, R. P., C. E.
Leavell, R. A., M. E. Thomas, Wm. E., M. E.
Williams, D., C. E.

1911
De Tar, DeLos, E. E. Pettibone, G. D., E. E.
Doering, R. C., F. P. E. Salomon, M. J., C. E.
Gray, R. L., E. E. Schmidt, E. J., M. E.
Griffiths, F. H., M. E. Schultz, W. E., F. P. E.

1912
Curren, Earl L., C. E. Newman, J. J., Ch. E.
Enoshita, Toyozo, E.E. Swanson, W. R., C. E.
Hazen, Fred G., E. E. Turley, E. W., Ch. E.
Yoshida, H. T., M. E.

1913
Arp, W. B., E. E. Lundblad, C. D., Arch.
Crow, Ralph M., Arch. Moore, F. L., Ch. E.
Furay, C. J., Arch. Munn, W. K., Ch. E.
Garrison, C. W., C. E. Schwiemann, O. J.,
Kuehn, Hugo R., M. E. M. E.
Lill, A. C., C. E. Stanley, H. C., Arch.

NEW LIFE MEMBERS

SINCE MAY ISSUE

HALL PERRY C.	E.E. 27
KLEIN SAMUEL	C.E. '06-'09
POMEROY CHARLES ROSS	M.E. '17
TULLY ALAN C.	C.E. 28

1914
Auer, P. Fenton, C. E. Kann, W. H., C. E
Barber, G. S., Arch. Morrow, A. W., Arch.
Barr, Allen W., Arch. Roberts, W. F., C. E.
Boetter, C. L., C. E. Schmidt, C. D., Arch.
Case, Harry L., E. E. Sevin, Irv. M., C. E.
Cooley, G. S., M. E. Shane, J. L., Arch.
Wight, J. C., Arch.

1915
Hirose, Yosh., Arch. Minchin, S. H., Arch.
Johnson, V. E., C. E. Parrott, R. D., Ch. E.
Mammes, H. A., E. E. Shaffer, Sydney, E. E.
Mieczkowski, T.K., E.E. Stark, A. G., Arch.
Wong, J. K., M. E.

1916
Adams, R. S., C. E. Foy, Edgar A., C. E.
Apfelbach, H. J., Arch. Harris,H.S.(Katz),E.E.
Appelbaum, A., C. E. McHugh, L. J., C. E.
Bland, Henry, E. E. Miller, J. V., M. E.
Broman, J. G., M. E. O'Dea, T. M., Ind. Arts
Eames, E. R., Arch. Sostheim, B. B., C. E.
Finck (Finkelstein), Volz, W. H., Arch.
S. C., Arch.

1917
Cooper, Earl C., M. E. Morse, Ralph L., M. E.
Goldberg, L. I., C. E. Prochazka, R. V., E. E.
Kendall, S. W., Ch. E. Turner, J. W., Arch.
Vesely, W. J., Arch.

1918
Andre, Guy L., M. E. Kerr, Volney A., M. E.
Durham, E. J., M. E. Lewin, Edw. P., Arch.
Erickson, R. A., E. E. Twery, L. E., Arch.

1919
Cowles, F. S., Arch. Mintz, Chas. W., F.P.E.
Dady, Wm. E., Arch. Schimek, A. F., Arch.
Geldmeier, H. F., E. E. Senescall, Clyde, C. E.
Gold, C. L., C. E. Wallace, M. R., Arch.

1920
Bloomberg, S., E. E. O'Connor, W. J., Arch.
Fainstien, M., C. E. Podolsky, D. H., Ch. E.
Frank, Julian, C. E. Popkin, J. L., Arch.
Karlson, Jns., Arch. Smely, Jas., E. E.
McEldowney,H.B.,Arch. Wong, Yuk Man, M. E.

1921
Bloom, Louis S., E. E. Muramoto, D. K., E. E.
Browde, A. M., Arch. Pearce, Wm. W., E. E.
Kaplon, Hilton, Ch. E. Rudd, E. B., Ch. E.
Mundt, Edw., C. E. Zahrobsky, G. J., E. E.

1922
Bernstein, Jacob, C. E. Gambal, John J., C. E.
Bissel, Woodbridge, Georgevick, Elias, M.E.
M. E. Herman, B. S., M. E.
Conner, Geo. D., Arch. Mason, E. B., C. E.
Eierdam, E. C., C. E. McCormack, W.J.,Arch.
Eisenstein, Sam., M. E. Paque, W. W., M. E.
Erlandson, N. H., E. E. Rehnquist, P. A., M. E.
Silverberg, S., Ch. E.

1923
Bland, Henry, E. E. Graicunas, V. A., M.E.
Clark, A. S., Arch. Miller, D. F., E. E.
Crane, Geo. D., Ch. E. Oboler, Max O., E. E.
Dolesh, F. J., E. E. Pollan, H. T., M. E.
Downs, F. C., Ch. E. Schwartz, M. L., E. E.
Goldstein, A., M. E. Sommers, L. H., Arch.

1924
Anderson, H. E., Arch. Johnson, E. A., Arch.
Baim, Eugene, Ch. E. Lipsky, Wm. S., M. E.
Bensinger, E. A., Ch.E. Murner, H. K., C. E.
Davidson, D. E., M. E. Nelson, Carl A., M. E.
Falconer, J. W., E. E. Olson, Alden T., C. E.
Greenfield, F.(Isr.)Ch.E. Samuels, Saul, C. E.
Hart, I. H., E. E. Spaid, O. M., F.P.E.
Vickers, W. H., M. E.

1925
Beck, M. D., Ch. E. Nudelman, C. S., C. E.
Gaylord, R. P., F.P.E. Prendergast, R. W.,
Johnson, J. G., Ch. E. Arch.
McFaul, Don. J., M. E. Rose, Geo., Jr., M. E.
Novitsky, P. P., Ch. E. Schwarz, Edwin, E. E
Willey, S. R., C. E.

1926
Beeker, Geo., Arch. Jacobs, Leo B., Arch.
Blume, L. J., Arch. Kloer, C. G., Arch.
Hamid, C. A., M. E. Kornacker, F. J., C. E.
Reeder, C. D., E. E.

1927
Berkson, Aaron, Arch. Lee, Geo. Harold, E.E.
Cailles, B. A., C. E. Mazzone, S. A., Arch.
George, H. R., Jr., M.E. Ohlinger, Leo. O., C. E.
Goo, R. Y., Arch. Schesch, Carl, M. E.
Heyes, A. B., E. E. Verano, Victorio, C.E.
Larson, E. A., E. E. Weinberg, Jos., E. E.

1928
Bech, Jose A., M. E. Miller, Leo, F. P. E.
Gustafson, G. A., E.E. Ogden, Tom, C. E.
Jones, C. S., E. E. Reynolds, M. E., E. E.

1929
Garbett, R., Ch. E. Rohr, E. K., F. P. E.
Montgomery, G. M., Strom, G. W., E. E.
C. E.

1930
Dylewski, T. J., E. E. Peterson, F. B., E. E.
Goldman, J. R., Ch. E. Taylor, J. L., E. E.
Kilbourne, R. E., F.P.E. Tell, F. O., Arch.
Miller, Max J., M. E. Wood, M. B., C. E.

1931
Chin, E. W., Arch. Lopatowski, E. J., C.E.
Dodson, Chas. E., Arch. Miles, Wallace, Arch.
Ferguson, L. J., Ch. E. Moore, G. R., F.P.E.
Hotchkin, M. A., F.P.E. Pilgrim, H. J., M. E.
Yzaguirre, M. A., Ch.E.

1932
Combs, H. F., Ch. E. Jungels, A. J., M. E.
Eskonen, O., C. E. Miccucio, M. J., E. E.
Fox, Chas. H., C. E. Skrakowski, Edw.,
Hawes, Chas. S., M. E. Ch. E.
Hromada, F. M. C. E. Tonpeekoff, E., M. E.

1933
Belton, Geo. R., M. E. Sanchez, Joe R., E. E.
Tyler, W. W., E. E.

1934
Eberly, Kenneth, Ch. E. Marcus, Leonard, C. E.

1935
None

1936
Olson, E. W., Arch.

1937
None

1938
None

STUDENT UNION

(From page 47)

In order to facilitate service, a self-service unit has been installed. This comprises approximately 44 feet of cafeteria counter with a cold units for salads and drinks and a steam table for hot foods. In addition, there has also been incorporated in a section of this unit, a soda fountain for those who prefer the lighter foods.

The entire top of the serving unit is constructed of stainless metal to facilitate cleaning and to prevent corrosion and deterioration.

A back bar is provided which will facilitate the preparation of certain food articles such as plain and grilled sandwiches, toast, etc.

Two sections of heavy duty hotel type ranges, made by the Garland Range Company, are provided in the kitchen, also a combined grill and griddle. These are all mounted under a heavy metal hood which is connected by a duct to a positive blower which provides the required exhaust for the kitchen.

All of the dishes, silverware, and glassware will be washed in the crescent electric dishwashing machine in the kitchen. This machine will automatically wash the dishes, and, further, sterilize them at the proper temperature. This machine has been incorporated in the kitchen as an added protection for the health of the students.

Nothing has been overlooked to insure a complete model kitchen and dining room for the use of the Student Union.

Millwork

Practically all the millwork, such as doors and cabinets, were supplied by Hartman Sanders Company of Chicago.

Stage

The stage in the student hall has been completely rebuilt, and numerous electrical outlets have been pro vided to meet the requirements o various student organizations such a the Armour Players musical organiza tions, etc., and also the regular func tions of the Institute. A public ad dress system has been provided fo assemblies and similar meetings.

Student Hall

The floor of the old auditorium ha been completely relaid by the Ander son Floor Company, of Chicago, wit matched hard maple flooring, and i now is all on one level.

Large study tables are provided un der the balcony, five on either side each of which will accommodat twelve students. The central portio of the main floor of the student hal will not ordinarily be occupied, ex cept for perhaps exhibition purposes and the chairs from around the stud tables and those in the meeting room will be arranged on this floor for as semblies and mass meetings.

Exit Lights and Fire Sirens

All exit signs are illuminated b electric lamps and conform to th city requirements.

An electric siren is located behin a grille in the ceiling of the entranc to the student hall, and it may l operated from no less than five poin throughout the building.

Electric Clocks and Signal Bells

A number of electric clocks are i stalled, which operate on a speci A-C circuit provided for this purpos

The class signal bells are co trolled by the master clock on the se ond floor of main building.

Sound and Picture Projection Machi

Suitable circuits are provided f the operation of the sound and pictu machine recently presented to the I stitute by the *Armour Tech News.*

Resilient Floors

All resilient floors and stair cove ings throughout the building we

(Turn to page 52)

STUDENT UNION

(From page 50)

supplied and installed by the E. H. O'Neill Floors Company of Chicago.

Check Room

The check room on the first floor is equipped with very modern checking equipment supplied by the Vogel Peterson Company, Chicago.

Furniture

The furniture in the student lounge and ladies' rest room was furnished by Marshall Field & Company of Chicago. They also furnished the window drapes and valence over the stage.

The dining room pedestal tables, study tables and chairs, and meeting room chairs, were furnished by the Wisconsin Chair Company of Port Washington, Wisconsin.

Food

The management of the dining hall assure us that all supplies will be of the highest quality and that the quality, preparation, and appearance will satisfy the most exacting taste.

Acknowledgment

It seems only fitting that acknowledgment be given here for the valuable service rendered by alumni, faculty, and friends of the Institute in connection with this project.

CHICAGO SUBWAY

(From Page 11)

one-third of the north side service will continue to come in over the Wells street elevated structure and operate around the loop.

The Logan Square and Humboldt Park trains would operate over the elevated structure to the connection with the subway near Milwaukee avenue and Paulina street, thence in the subway to Dearborn and Congress streets, where they would switch back and return over the same route.

All trains operated in the subway would be of steel or other metal, modern-type construction. The utmost in safety could be provided with the latest signalling devices and automatic train stops to prevent collision of trains. Adequate ventilation is provided for by using fans wherever necessary. Escalators will be installed at deep level stations. Pedestrian passageways in Randolph and Adams streets will connect the west side subway with the north-south subway between Dearborn street and State street, enabling a transfer to be made without coming to the surface.

Construction Methods

Both subways are planned to be constructed as tunnels. The exact cross-section to be adopted is now under consideration jointly by the

P. W. A. and city engineers. Between stations, subways will consist of two single track bores, about 20 feet in outside diameter, each of which will contain a single track and will be of dimensions sufficient to clear a modern type rapid transit car—9 feet 6 inches in over all width.

At stations, the two single track tunnels will be so constructed as to permit the construction of either center island platforms from 20 to 22 feet in width or two side platforms each 12 feet in width. Tunnels will be located in the soft blue clay which underlies the top soil throughout most of the area of Chicago, so that a minimum seal of 3 feet of that material will be provided. In the central district, the top of the soft blue clay is generally found at about Chicago City Datum so that the top surface of the tunnel will average about —3 or 17 feet below the top grade in most of the Loop streets. This will place the rail grade at approximately —23 and the platforms at —19 or about 33 feet below the sidewalks.

The ordinary tunnel operations at this depth in the more congested part of Chicago is carried on under 6 to 8 pounds of air pressure. The soft blue clay is well adapted to tunneling operations. The present practice is to excavate two or three feet ahead and then install a course of corrugated steel "liner plates," stiffened and braced by ribs of angles or light I-beams; no timber bracing is used, in order to minimize the fire danger.

It is common practice to excavate the clay with such accuracy that a space of less than an inch will be left between the clay and the liner plates when these have been installed, but even this space is filled by grouting to prevent settlement, or flow, of the surrounding earth which, in turn, might cause settlement of adjacent buildings or other structures.

The concreting of the tunnel follows immediately after the excavation and the placing of the liner plates, and continuous operation (24 hours a day) is therefore advisable.

After the tunnels are completed, mezzanine stations will be constructed by cut and cover methods. These structures will be from 50 to 75 feet in length—generally extending from curb to curb. Vertical clearance will be a minimum of 7 feet 6 inches. The top surface of the mezzanine will be 7 to 9 feet below the pavement or below the zone in which most of the underground utilities are located.

Entrances to mezzanine stations will be located in the sidewalk and in some cases, by special arrangement, through adjacent buildings. Stairways

will lead from the sidewalk to the mezzanine level. The climb from station platform to the mezzanine will be facilitated by the installation of escalators.

Separate contracts will be let for each of a number of sections, so that work may proceed simultaneously along the entire project, since the work is to be carried out in a period of 20 months, so as to be substantially complete on July 1, 1940.

Benefits Derived

Subways are needed as an aid in promoting better mass transit service, for improving general street traffic conditions, and for providing facilities for more uniform development of the central business district through which half of all the city's traffic, mass transportation, and automobile, passes daily. The specific benefits that may be expected from the subways on which construction is soon to start are:

1. 60,000,000 riders annually may be expected to use the north-south subway as soon as it is constructed, and, based on present traffic handled by the elevated, 13,000,000 riders annually may be expected on the Milwaukee avenue subway, the use of which can be expected to increase rapidly because of the intensive development on the northwest side.

2. Time savings will result to users of the subways, the extent depending on their destination. If we consider State and Madison streets as a focal point, it is estimated that a saving of 10 to 12 minutes will result for riders coming in from the northwest over the Milwaukee avenue subway. Users of the State street subway from the north side would save 7 minutes or more. Users of this subway from the south side would save from 2 to 3½ minutes.

3. Congestion caused by operating a greater number of rapid transit cars around the two-track loop structure than can be operated efficiently, regularly results in slowing down rush-hour trains up to seven minutes behind schedule. The additional track capacity provided by the subways will eliminate this unsatisfactory condition and provide for faster time on all elevated rapid transit trains using the loop structure.

4. New areas will be opened up. The State street subway with stations at Grand avenue, at Chicago avenue, and at Division and Clark streets will aid materially in the development of the near north side. The new subway stations on Milwaukee avenue, which will probably be located at Division street, Chicago avenue, and Grand avenue should aid in stabilizing business and property values in these sections.

5. With the attraction of riders to the subway service either from surface street railway and bus operation or from private automobiles, improvement in street traffic conditions may be expected.

As the subway program is expanded, additional benefits may be expected. Following the construction of a connection with the Lake street elevated and a connection over Van Buren street or Congress street from Dearborn street to the main line of the Metropolitan Division of the elevated near Halsted street, the north and east sides of the elevated loop structure may be removed.

After completion of the above and after the construction of a subway in Wells street to take care of the traffic from the north side which cannot be diverted to State street, the entire loop structure could be removed.

It is our belief that the street car subways in Washington and Jackson streets should ultimately be built, removing two-way street car traffic on seven east and west streets and providing a terminal for these car lines east of Michigan boulevard instead of being limited to Dearborn street as they are at present. Their construction, in addition to providing time savings for individual riders of from 4 to 8 minutes, would provide a direct aid in distributing passengers arriving at the Northwestern Station, at the Union Station, and the Randolph street and Van Buren street Stations of the Illinois Central Railroad. There are 50,000,000 suburban passengers annually coming in over these railroads, who would be benefited, in addition to the 60,000,000 riders of the street cars who would use these subways, and the 50,000,000 passengers in automobiles coming in over the streets who would be relieved from the delays due to congestion caused by the operation of street cars.

Upon the completion of the initial system designated for immediate construction, it is confidently believed that the demand for expansion of this type of service will lead to consideration of further improvement of both rapid transit and surface facilities through the construction of many additional subways.

FACTORY LIGHTING

(From page 18)

spect that those who have practiced and applied scientific lighting in their plants are very well satisfied.

The empirical era has been left behind. The Illuminating Engineering Society has progressed rapidly in dealing with the lighting of industry. Is this again the end of all progress? No, it is not. New methods and machines are coming into use in all industries. As can be expected, the changes in the manner of production call for changes in lighting. At the same time there are many problems that as yet have not been solved satisfactorily. All those things and many more cause investigation to continue. But the problems in lighting today are attacked with scientific knowledge, accurate light and sight measuring instruments, and the findings of field investigations using basic seeing science and accurate instruments. Who then can deny that the era of scientific factory lighting has arrived?

AIR CONDITIONING

(From page 26)

body in three ways: by evaporation from the skin and lungs, by convection or heat interchange with the surrounding air, and by radiation to surrounding objects. The minimum temperatures for comfort and with the person at rest, the disposal of heat by the body by these three methods at normal room temperature are about in the following proportions: evaporation 24%, convection 30%, and radiation 46%.

In a room, however, where the air and surrounding walls are at average skin temperature, obviously no heat is removed by either radiation or con-

vection, and the entire output of heat from the human body is in the form of latent heat of evaporation. In the human being, of course, this comes primarily from the skin. Between these two points the percentage of heat removed by evaporation is nearly a straight line relationship. This, of course, should be expected because with relatively constant metabolism over a considerable range of effective temperatures, the equilibrium of body temperature is maintained largely by variation in evaporation.

A rather surprising corollary to this principle is that the rate of evaporation from the body is independent of the dryness of the air, contrary to the usual supposition, and is dependent solely upon the dry blub or sensible temperature of the air and surrounding objects. It is also a fact that the difference in heat generated by a person at rest and that by one doing muscular work must be dissipated largely by additional evaporation. This also is independent of the dryness of the air. The human body obviously does not follow the law of evaporation from a wetted surface, but its evaporation is controlled solely by the heat regulating mechanism which increases or decreases the amount of moisture available for evaporation in order to maintain a balance between metabolism and heat loss.

While it has been shown that a person at rest can endure conditions as severe as 87° effective temperature, or the equivalent of saturated air at 87°, yet his ability to do work rapidly decreases at effective temperatures above 75°. This is measured by an individual performing the maximum amount of work for which he was capable under different conditions. At 93° effective temperature he could accomplish only one-half the work that he could at 75° effective temperature. Interesting data under working conditions have also been presented by Vernon for British coal mines. The relative output for miners at 82° effective temperature was 59% of their output at 66° effective temperature where it was the maximum, while at 75° effective temperature their output was 91% as great as that at 66°. This shows the important part that air conditioning can play in increasing the efficiency of the worker. The improvement of temperature and humidity conditions by air conditioning also plays an important part in reducing industrial accidents. Osborn & Vernon found that the frequency of accidents in the British munition factories reached a maximum at 67½° dry bulb temperature and that they increased rapidly above and below this tempera-

ture. This was with average normal relative humidities.

Under more adverse conditions such as those met at the Moro Velho gold mine in Brazil, twenty fatal accidents occurred in sixteen months before the installation of a refrigerating and air conditioning system, when the effective temperature in the mine averaged 90½°. During the sixteen months after the installation of the equipment, only six accidents occurred because of greatly improved working conditions.

The physiological effect of uncomfortably high temperatures and humidities seems to be principally that of increased fatigue, and this not only lowers the efficiency but reduces the alertness of the individual in avoiding accidents. Exact industrial data as to health and efficiency of employees are usually difficult to obtain and sometimes more difficult to interpret accurately. The following are some of the facts obtained which indicate the improvement in health and efficiency of employees as a result of air conditioning.

The management of the *Los Angeles Times* has stated, "We have an employes' organization composed of some 1100 of our people engaged in the several departments of The Times Building. It is in fact a mutual insurance group paying sick benefits for time off because of illness. The organization has been in existence between ten and eleven years and in checking up the health record, based on the relative number of days off because of illness, it developes that in the first year of occupancy of the air conditioned building there was a decrease of 46% in illness serious enough to cause layoffs—in other words our employees in the building were 46% healthier than they had been during the best of the previous ten or eleven years since the mutual insurance plan for our employees has been in operation. In any event the annual assessment for the year was 46% less than it had been in any of the preceding ten years."

Thomson & Company, New York printers, report that "during the period of about fifteen months since . . . air conditioning apparatus has been in our plant, we have not had to make a single claim on the Metropolitan Life Insurance Company on account of illness to employee."

The Chicago Title & Trust Company state in relation to their air conditioning installation, "We have found that it has increased efficiency. We have also found that the "afternoon lag" has been greatly eliminated; in fact, our employees in the summer months prefer to remain in rather than

go outdoors for their noon-day lunch. No one seems to be logy or sleepy in the late afternoons. Apparently they are just as refreshed at four in the afternoon as at nine in the morning."

The results of a questionnaire sent to tenants in the completely air conditioned office building of the Philadelphia Saving Fund Society were as follows: 92% stated that air conditioning was beneficial to their health—95% felt that their efficiency had been enhanced—90% reported less fatigue in summer (72% in winter)—82% reported fewer winter colds—65% said that their colds were less severe—65% of those afflicted with hay fever said they had been benefited." The latter, of course, are merely individual reactions which have a qualitative but not a quantitative value.

The acclimatization of people to different conditions is quite interesting. In England, for example, where the climate is relatively cool in summer and little heat is employed in the home, temperatures of 65° to 70° in factories which are common with us would be altogether too warm for the British workers, and temperatures of from 80° to 85° with high humidities which our workers stand without noticeable ill effects in summer, would be considered insufferable in England. On the other hand, workers in tropical and semi-tropical countries such as India, for example, require temperatures above 80°. An illustration of this was found in the first air conditioning plant installed in an Indian cotton mill. It was started up during the monsoon season when the outside temperature was 105° and the air was very dry. The mill temperatures which the Indian workers were used to ran as high as 110° and 115°. The engineer in charge was greatly delighted when on a 105° day outside he maintained a temperature of 80° with 80% relative humidity inside the mill, but the Indian operatives refused to work in so cold an atmosphere, and he was obliged to provide a means for heating his spray water.

H. C. Bazett says in his article on physiological responses to heat in *Physiological Review*—"The acclimatization of natives to their own climatic conditions is well recognized. This may be noted even among the varying climates of one country; thus the high room temperatures common in American houses, and often criticized, merely reproduce the ordinary "comfortable" summer temperature of the locality and are in consequence higher in the southern than in the more northern states. The tendency seems to be to maintain conditions as uniform as possible."

Studies are now being made on the optimum temperatures in conditioned buildings with reference both to comfort and to shock, either in entering or leaving the conditioned space. It is common knowledge that many of our conditioned spaces are kept altogether too cold for either comfort or health. This is not the fault of air conditioning because the temperature can be controlled at any desired level. The users and operators of air conditioning equipment need education. The undesirable low temperatures frequently found are often the result of the owners to "show off." This undesirable state of affairs will gradually disappear as air conditioning comes into more general use.

Professor C. P. Yaglou of the Harvard School of Public Health has made some very interesting investigations of optimum temperatures, both winter and summer, and found a great variation between individuals. He found the summer zone of comfort for different individuals to extend between a range of 64° effective temperature to 79° effective temperature and the point at which 98% of the subjects were comfortable was at 71° effective temperature. This checks fairly well with the results in the U. S. Senate. There the optimum effective temperature in extremely hot weather was 74°, that is 82° and approximately 40% relative humidity. In general, it is better that the temperature be maintained somewhat above the optimum rather than below. Less harm is done by some people being too warm than by allowing other people to suffer from being too cold.

The air conditioning engineer welcomes any assistance that the medical profession can give on this important subject of optimum summer temperatures with relation to outside conditions of temperature and humidity. The engineer can produce any condition within reason desired. He can determine statistically what conditions produce optimum comfort to the occupants of a building under varying conditions, but he does not pretend to be competent to measure the beneficial or unfavorable effects of such temperatures. For this he must rely on the medical profession.

It is quite probable that if engineers and physicians could come to some sound demonstrated basis of agreement, measures could be taken to protect the public against improper use of air conditioning equipment. This should have the effect not only of safe-guarding the public but of increasing the general acceptance and the extension of the benefits of air conditioning to people generally.

THE RIGHT ROAD

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Armour ENGINEER and Alumnus

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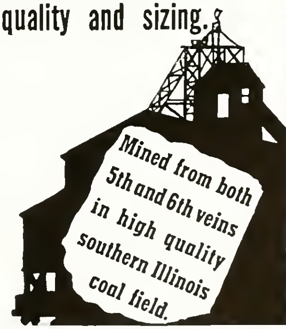

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Ideals are as different as viewpoints, but real success is not wealth or fame, but helpfulness. Do something worthy of your powers. Shoemakers and stokers are as necessary as scientists or statesmen, and any helpful work is honorable, but to be a tinker when you might be a thinker is to be unsuccessful. He who moulds iron when he could shape destinies, or guides a ship when he could direct an empire, fails. Success consists in never being discouraged, but in ever moving forward, cheering, helping, being your very best, and leaving the world the better for your life.

—A. R. Johns, Albion, '95

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and ALUMNUS

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IN THIS ISSUE

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■ *C. W. Galloway*, Vice-President, Operation and Maintenance, of the Baltimore & Ohio Railroad, entered the B. & O. railroad service as a messenger in the telegraph department in 1883, and served successively as clerk, stenographer, and secretary in many departments of the company until 1897 when he was made train master of the Baltimore Division. Since that time he has served as division superintendent, superintendent of transportation, general superintendent, general manager, federal manager, and vice-president, and since 1920 as vice-president in charge of operation and maintenance. Mr. Galloway represents the third generation of the Galloway family who have served in official capacities for the B. & O. Railroad since its beginning. He is a member of numerous clubs, also a member of the Board of Directors of the Maryland Institute.

■ *Charles F. Kettering* was born on a farm in Ohio. He attended Wooster Normal School and graduated from Ohio State University. Dr. Kettering, who is now Vice President of General Motors Corporation in charge of research, has the remarkable gift of taking difficult problems apart, finding out the cold facts, and working out the solution.

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■ *H. T. Heald* is President of Armour Institute of Technology.

■ In 1936, an advisory committee composed of prominent Chicago architects was formed to make a study of the problem of developing at Armour Institute a school of architecture of outstanding merit. This committee, after careful and deliberate investigation and study, recommended the appointment of Ludwig Mies van der Rohe, internationally-known, modern architect as director of the department. Mr. Mies van der Rohe started his architectural career in Berlin, where he became associated with Peter Behrens, whose pioneer work gave impetus to the growth of contemporary architecture. He represented Behrens in Leningrad during the building of the German embassy there. He was architect for the German exhibition in the World's Fair at Barcelona, and director of the famous Bauhaus in Dessau, Germany.

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■ *Walter B. Stearns* is president of Stearns & Voyta Photo Engravers Co. of Chicago, a modern, well-equipped engraving plant. Mr. Stearns has been associated with this company for eight years, having previously spent a number of years in the advertising field.

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FROM HORSE POWER TO DIESEL POWER

by
C. W. Galloway

The subject, "From Horse Power to Diesel Power," that I have been asked to discuss briefly, is one which should have a real appeal to any B & O man. For as nearly as I have been able to find, the B & O, which was unquestionably the first commercial railroad in the United States, was the only railroad ever begun with the idea that horses were going to run between its rails, pulling cars carrying freight and passengers.

And so it began. The first public railroad service ever given in this country was on January 7, 1830, when the B & O hauled passengers from its Mt. Clare station in Baltimore out to and over the Carrollton Viaduct three miles away and return. And the passengers weren't dead-heads, but paid a goodly fare even if horses did pull the cars on which they rode.

Incidentally, that old Mt. Clare station, sturdily built of brick in 1830, is still standing. Indeed, it is still doing business as the headquarters of an assistant agent of the B & O. It is the oldest railroad station in the world—older than any even in England, the mother of railroads.

And that same Carrollton Viaduct, with its one great sweeping arch, is still standing as originally constructed. It is the oldest railroad bridge in the world, and carries our heaviest locomotives and trains.

Five miles west of it, at Relay, is the B & O's beautiful Thomas Viaduct, completed in 1835 to carry our trains across the Patapsco River on their way to Washington. This viaduct was called after its designer, "Latrobe's Folly." Few thought that it could be built and stand on the eight huge stone arches that carry it on a sweeping curve over the Patapsco Valley. But there it is today, the oldest multi-arch railroad bridge in the world. And both it and the Carrollton Viaduct, without essential changes in their construction, but with careful maintenance, are now supporting locomotives weighing upwards of 350 tons, whereas the first engines for which these structures were designed to carry weighed ten tons and less.

[Editor's Note]

This article is the address of Mr. C. W. Galloway, Vice-President, Operations and Maintenance, of the Baltimore and Ohio Railroad, given November 23, at the Annual Transportation Luncheon of the Chicago Association of Commerce on the occasion of the christening of the new B. & O. Diesel-powered, streamlined Capitol Limited.

Mr. Galloway talking before the assembled crowd in the Grand Central Station, Chicago. In the background is a replica of the original "Tom Thumb"—the first American locomotive. On the left is the new Capitol Limited.

The new Diesel powered streamline Capitol Limited of the Baltimore and Ohio Railroad crossing the Potomac River on the main line just east of historic Harper's Ferry, Maryland.

You have heard your chairman say that my grandfather and father were both B & O men. Yes—and I can truthfully add that as a boy I have heard both of them talk about the old horse cars, my grandfather, William Galloway, having driven them. In fact, it is claimed, he drove the first horse car from Baltimore to Ellicott's Mills, a distance of thirteen miles. Then my father heard his father talk about them, and he told me. So, of all B & O men, perhaps I, having this tradition, and having myself worked in the smell of B & O steam and smoke for fifty-five years should be able to say something on my subject.

But I am not a locomotive expert, and even if I were, I'm sure that you would not want me to talk about the technical development suggested by the topic. Rather, I'll quickly cover some of the high lights that may be of interest to business men like yourselves.

It seems strange that the men of great vision who founded the B & O in Baltimore in 1827 thought literally in terms of horse-power, or "Hay-burners," as they have been called. But they had to do something, quickly, to compete against the subsidy given the rival port of New York through the completion of the Erie Canal in 1825.

Although the founders of the B & O favored horse-power for their trains, they were hospitable to anybody offering anything better. Hence, when Peter Cooper, New York inventor and manufacturer, knocked on their door, they received him gladly.

Railroads Would Enhance Land Values, Thought Peter Cooper

Cooper was a rich New York inventor and manufacturer. He is best remembered now for the great educational monument he founded in New York, for Cooper Union has been the inspiration of a number of outstanding Americans.

Cooper was also one of Baltimore's largest absentee landowners, and when he heard of the new railroad, he surmised that it might spell opportunity for him. He was probably the first American who sensed the fact that the railroad was to create greatly increased land values. After him, their number was legion.

Cooper came from New York to Baltimore. He had little more than an idea. But the B & O let him develop it in their Mt. Clare Shop. As a result, the "Tom Thumb," so called by its inventor because it was so tiny and insignificant, and which you can see at our Grand Central Station, today, proudly moved out of the shop under its own steam one autumn day 109 years ago. Its flues were made

of old gun barrels. It lost its historic race to the horse-drawn car on August 25, 1830, because of the slipping of the blower belt and the loss of steam, but it proved for all time that steam had come to stay on the railroads—at least until Mr. Kettering and his associates recently came on the scene.

And that, perhaps gives me my best opportunity to jump over the whole century of locomotive development that intervened. I wish that this were an occasion on which I could touch on just a few of the intensely interesting events that locomotive progress brought during these hundred years. But we can at least agree that they marked the greatest progress of any nation in the world, and we railroaders feel that by and large the steam locomotive was the flaming torch that was in the forefront of the vanguard.

However, I can say to Mr. Kettering and his associates of the General Motors Corporation and its Electro-Motive Division, that we are glad that they *did* arrive on the scene. We would have been unworthy successors of these ancestors of ours had we not opened the door when they knocked. And when they did, we, like the founders of the B & O, saw opportunity before us, the opportunity of giving Electro-Motive's first 3600 H.P. locomotive its first comprehensive road test: from Chicago to Washington, to New York, thence back to Washington, and on over our two highest Allegheny Mountain ridges to Cincinnati and St. Louis, thence over our Alton Line to Chicago. Locomotive history was made on that run.

The best proof of what that meant was our purchase of the first 1800 H.P. Diesel electric locomotive delivered to any railroad. That locomotive has hundreds of thousands of miles to its credit. It first operated our Royal Blue Limited between New York and Washington, and is now daily speeding the Alton's Abraham Lincoln from Chicago to St. Louis and return.

More evidence of our confidence and faith came when we placed orders for two of the 3600 H.P. units, then another two, and still two more until we now have six.

May I give my testimony for the Diesels in a word by saying that it would be impossible for us to haul on its present fast schedule this beautiful, newly streamlined Capitol Limited, inauguration of which you have kindly gathered to celebrate, with any steam locomotive on the B & O, but we can *and do* do it with the Diesel electric—and at an even, sustained speed, usually on time—and with more time up our sleeve if our competitors get too *gay* in shortening schedules.

The first 3600 H.P. unit that was delivered to us hauled a regular train of fourteen heavy passenger cars, mostly Pullmans from Chicago to Washington. We made a station stop going up the west side of the Alleghenies. We were on a one per cent ascending grade and I was riding the Diesel and wondering what the big fellow was going to do. Perhaps, lifelong lover of the steam locomotive that I am, I hoped "she wouldn't." But to the delight of all of us the station outside seemed gradually to be moving backward.

We had started easily and without the slightest tremor in the train, and apparently without much effort. We have no high-speed steam passenger locomotive that would do that alone. But maybe it's coming. In our own interest we on the B & O can't forget that nearly half our total tonnage and a large part of our revenue come from the hauling of coal. And unlike gasoline—and the oil that is burned in the Diesel electrics—they haven't yet built pipe lines for coal. Furthermore, the efficiency of coal combustion on the railroads and in industry has been greatly increased during recent years.

A short time ago I read an official statement to the effect that only two per cent of the coal now known to exist in West Virginia, where the B & O has been taking it out for nearly a century, has been mined. I don't know how that compares with the known supply of oil available for the future, but my impression is that the oil reserves are relatively far less reassuring.

For these and other reasons we naturally want to increase the usefulness and consequently the uses of coal. Obviously, we should begin at home, and that is exactly what we have done with the designing of a new type coal-burning locomotive. We call it—borrowing the phrase from our automotive friends—a Constant Torque type.

Briefly, it will have four driving axles, each independent of the others. Each axle will be driven by a four-cylinder steam engine, and all four engines will get their steam from a single boiler. The gear reduction ratio from engines to axles will be such as to give sixty-four power impulses to each revolution of the drivers. That sounds like a lot of machinery and a lot of motion, but it isn't so much when you compare it with the 750 power impulses that are taking place every minute in each one of the forty-eight cylinders of the Diesel electric locomotives, such as we operate, at normal speed.

At any rate, we are going to build such a locomotive, and we believe that it will produce 5,000 horsepower and haul a fourteen-car train on level, straight track at 100 miles an hour—which is faster than the average and faster than I want to go on any man's railroad. Of course, the plan is merely to use steam in much the same way our automotive friends burn oil vapors in their engines. Perhaps, Mr. Kettering, if we get into trouble, you will come over and help us. We will surely call on you should we get stuck. We know your resourcefulness.

Now, to you Chicago business men, I want to unfold a remarkable coincidence that this happy occasion has brought about.

In 1870, forty-three years after the founding of the B & O, our rails had not reached your city. We were still 200 miles away when John W. Garrett, Civil War president of the railroad, in addressing your Board of Trade on May 26, 1870, said, in part:

"I find all your merchants whom I have had the pleasure of meeting, full of appreciation of the fact that Baltimore has now risen to that position which makes it a matter of mutual interest for your city to join in securing this economical, independent, additional outlet. I trust, therefore, this important subject will be fully examined, and that it will command such approval and combined effort that in less than two years the National Capital, Baltimore, Pittsburgh, and Chicago, will be united by new and closer bonds and by mutual cooperative relations, which cannot fail to advance largely the convenience, interests, and prosperity of all the great communities which will be so sensibly affected."

Evidently the subject *did* command the interest, approval, and united effort President Garrett prophesied, since track laying commenced at Fostoria, Ohio, July 22, 1873.

The line from Chicago Junction to Deshler, Ohio, sixty miles, was opened for business on January 1, 1874.

The bridge across the Auglaise River at Defiance, Ohio, was completed and the line to that point was opened for business in June, 1874.

Track laying was completed from Chicago Junction to a connection with the Illinois Central Railroad at Parkside, Chicago, November 15, 1874 and the entire line was opened for business on November 23, 1874.

That was sixty-four years ago today when we are assembled here to celebrate the inauguration of our newly streamlined Capitol Limited. An unusually interesting coincidence I am sure you will agree.

RESEARCH, an INVESTMENT

by
Charles F. Kettering

[Editorial Note]

Dr. Charles F. Kettering, representing the Electromotive Corporation, presented this address, November 23, at the Annual Transportation Luncheon of the Chicago Association of Commerce on the occasion of the christening of the new B. & O. Diesel-powered, streamlined Capitol Limited.

MR. CHAIRMAN, Ladies and Gentlemen: I am sure it is a great honor to be here at this dedication.

I was very much interested in the chairman's statement that it is only a little over one hundred years ago that we had our first railroad. This year, when we were over in London, they were celebrating the one hundredth anniversary of the opening of the London and Birmingham Railroad. That sounds like a long time, but yet it isn't very long because we have pretty good records of four thousand years B. C. One hundred years is not very long.

Charles F. Kettering of General Motors receiving a citation of achievement from Edward J. Kelly, Mayor of Chicago.

The Diesel power that we have been talking about is only four and one-half years old, so it is a very, very young youngster. The thing that I think is interesting is that in four and one-half years this type of motive power has gone as far as it has. The reason for this, I believe, is that the railroads are the most progressive group of industrial people that I know.

All we did was to get a device that would turn a generator to make electricity. We had everything else. We had the desire, we had the management, we had everything else but something to turn the generator. That is the part we attempted to supply. Now the reason I mention that is that we sometimes do not realize how important a tool is. That is all our Diesel engine is, a tool for making current. Whether you use it to haul a train or to drive a boat or this or that is entirely a secondary thing. So our contribution has been just the development of a type of engine light enough for its horsepower not to overload the locomotive.

We need a lot of transportation. We need a lot of communication. Those apparently are the two things that wipe out one of the greatest hazards we have. That hazardous thing is monotony. That is the greatest hazard the human race has to face.

One man said, "I wonder why we need so much transportation." The other answered, "Why, don't you know? Nothing is where you can use it and nobody is where he wants to be." So we have to have transportation.

Now, I am here representing a very small and retiring bunch of fellows known as research engineers. We have had a lot of trouble. Every once in a while we meet a group of men who are just weeping with the idea that civilization is going back, and all that kind of thing. I don't believe that at all. I've had to reassure myself

All important parts of the Diesel locomotive undergo practical tests simulating actual operating conditions.

with the idea that it isn't so. We are in a very, very peculiar position in the United States, and I don't know whether any country at any time has ever been in such a peculiar position. I'm telling you this because it all reflects back against myself and my tribe. We have a tremendous amount of money in the bank. We have an enormous amount of material more than we can use. And we have an awful lot of people sitting around doing nothing.

All that that could mean to a primitive type of mind such as I have is that we haven't any projects for them to work on—and that's my fault. If we had some good projects, the money, the men and the material would all go to work. We have been talking about technological unemployment, about having so many things developed that we have stymied prosperity. That isn't so at all. We are laps and laps behind.

I've told this story in the presence of railroad men before, and I named the railroad company and got into trouble with it, but I'll tell it today and take a chance.

A man went down to the depot to catch a ten o'clock train. He got there at nine-thirty and the train had just gone—which was a very unusual thing. So he sued the railroad company for pulling out ahead of time. The case came to trial and it was proved on documentary evidence that the train did not pull out ahead of time—that it was twenty-three hours and thirty minutes late! And that's what's wrong with our technological development. We are not only one day behind, we are laps and laps and laps behind. If we had the projects we wouldn't have this difficulty.

Now, what's wrong with us? Well, I can tell you what's wrong with us. We are not smart enough to convince our bosses of what they ought to do. It's bookkeeping that's the trouble.

You can't run any industry in the world without having detailed cost accounts. Everybody knows it. A research man is working in a great industry in which 99.9 per cent of accounting is on details. He and his men come around with an idea, and they can't fill out any of those detail sheets. "Where are you going to get this done? How much is it going to be worth when you get it? What will it cost to manufacture?" They can't answer any of these questions. Now you can see what the auditor does. He says, "Where did you get all of those fellows? They know absolutely nothing. They can't answer a single one of the questions put to them. What's it going to cost? How long will it take to finish it, and what will it be worth when it's done?"

We research men haven't been smart enough to insure that we are not subject to that kind of accounting. We are the exception. But we are not the exception from the standpoint that there is not a corresponding type of accounting. Every insurance company in the world runs on another type of accounting which is known as the actuarial system, in which they don't try to follow details: they take the averages of a large number.

So research work, if it is ever going to be a success in modern industry, has to be accounted on the actuarial system. I say we just run an insurance company. General Motors Research is an insurance company and the amount that it costs to operate is the premium that you pay for the policy. What do we insure them against? We insure that there won't be anything technical come up that we won't know a little something about. That's all.

We guarantee that they won't be behind the times, so far as we are concerned.

Now we don't realize how slowly things move. We don't know how long it takes. You have had this one hundred years of railroad operation. You see what a magnificent thing it has been, but we don't realize how little we are and how unable to penetrate the future, no matter how imaginative we may be.

So we have to work on rules of faith. If the rules have been satisfactory in the past, we have to trust them for at least a limited period in advance.

This fall, when I was over in England I spent a day with the British Broadcasting Company at their television broadcasting station. They have been broadcasting pictures, or whatever you want to call them, for two years. They have gone a long way in two years, but when I talked to these young fellows who were doing the work, they were very much discouraged because, with the armament program and other things, they did not have as much money as they

would like to have. No research man ever has as much money as he would like to have. If he had, it would be the worst thing in the world for him. You don't develop ideas with money; you develop them with brains. The less money you have, the more brains you have to use.

So I said to these young fellows—they were sincere fellows—"I think the only trouble with you is that you are just ignorant. What are you doing?"

They looked at me. That is bad enough to tell an American, but to tell an Englishman it is twice as bad.

I went on, "Let's go back and look at any industry in England. Take the railways, the telegraph, the telephone, anything you want to take, and let's go back and see how good it was at the end of the first two years. Let's take the telephone. At the end of the first two years, I think you were telephoning about twenty-five miles out of London. I can imagine they had a banquet to celebrate it. It was a wonderful accomplishment. They would say, 'I don't see how you can ever hope to do anything more marvelous with it.'

"Suppose somebody like myself, irresponsible and disrespectful, had come into that dinner and said, 'You fellows have done a good job, but if you would just change that a little bit you could talk to America without any wires.' What would you have done?

"You would have just pressed the bell and called in the police. Because nobody could have had enough imagination at the end of two years, when they were just able to talk twenty-five miles, even to have dared to think of talking across the ocean without wires."

I said, "Now you go back and observe any one of these things at the end of two years, no matter what industry, and I am willing to bet that you are not a bit smarter at the end of your first two years than your predecessors were. If you think I have offended you, I apologize."

We can only look about so far ahead, but we have to recognize, first of all, two things: that we don't know anything about anything—that is thing No. 1; and the other is that we think we do.

The chairman tried to put me in bad here by saying that I said, "One of the first essentials in research is intelligent ignorance." I mean that. You have to get a group of young fellows who don't know anything about the business, who can analyze it without knowing all the difficulties you have gone through, but intelligent enough to do a good job. For if you take any group of highly experienced fellows—I don't care who they are—bring them in, give them any problem at all, the first thing they do is pull out a slide rule, give it about two slips, and say, "You can't do that."

Now what I mean by this is that we have certain limitations that have to be limitations as of this day, but all of the time we have to have men who are trying to break them. I want to get industry to understand the idea that I am talking about, and so I have worked out all kinds of ways to give different definitions of the thing we call "research." One of them is this: "Research is not a thing that you do in the laboratory. It is a state of mind. It is just an organized method of trying to find out what you are going to do when you cannot keep on doing what you are doing now." It has nothing to do with laboratories. It has nothing to do with science. It has nothing to do with anything of the kind. It is simply saying, "What are we going to do if we have to stop doing this today?"

We talk about scientists. Well, what is a scientist? I say that a scientist is a man who is working on a job that he does not know anything about. That is all he is. A researcher is a person who is working on a job we do not know how to do; otherwise it would not be a research job. But we try to make ourselves believe that we know so much more than we do. The fact of the case is we do not know anything at all. If we took the Latin and Greek synonyms out of our modern science, the books would be so thin you wouldn't need to have backs on them.

I want to tell you a little incident that happened last summer. A number of professors of physics came to our institution. They said, "We should like to get some projects for our boys to work on."

I said, "Just take up anything blindly and there is your project, because nobody knows anything about it."

(Turn to page 30)

Machining rotor of a Root blower used on large railroad Diesel engines.

A LARGE MODERN RADIO FACTORY

by

A. E. Bibby

RIGHT here in Chicago is located "the world's largest radio factory on one floor." This mammoth manufactory is capable of producing in an eight-hour day 10,500 radios for shipment to thousands of dealers in the United States and throughout the world. From this manufacturing center are served one hundred countries scattered all over the globe, and that, of course, takes in all the important countries on our planet, with few exceptions where trade restrictions might apply.

To visualize this monster capable of producing a daily stint of more than 10,500 radios a day, a quantity enough to fill a complete freight train of twenty-one cars, picture, if you will, a series of continuous production lines laid out roughly in the form of a giant "U."

At one end of this giant "U" are received all the varied and assorted parts, numbering in the thousands, that go to make up the modern radio set. As the parts flow along the first stages of manufacture, they gradually assume their positions as component units of the radio chassis, each one being put into its proper place by the deft hands of experienced radio operatives. Some chassis have as many as 3,000 separate parts to make the whole.

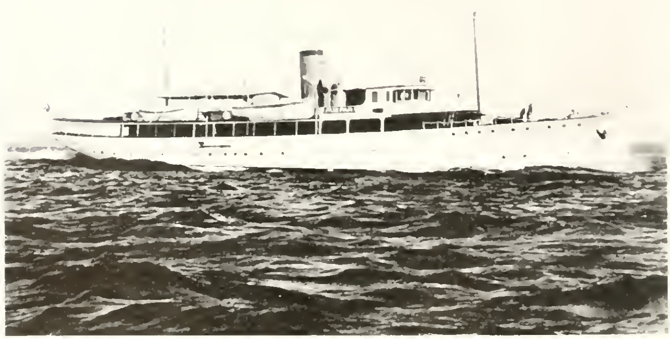
Gradually, as we follow the manufacturing line, we see each chassis emerge, pass through mechanical, electrical, and acoustic tests; see it housed in its proper cabinet and start down the "last mile" of the "U" for packaging and shipment to a purchaser who is "somewhere on planet Earth."

Thoroughly to inspect our modern radio factory on this journey, we follow the "U" shaped course of the production lines in easy stages. The building of a radio is a technical as well as a mechanical affair, and must be studied in detail if we are to form a mental picture of the complete process.

The basis of modern manufacture is power to aid the human hand and brain, and usually this power, no matter what its origin, is finally translated into electricity. In the radio factory, we find that so much power is required to operate hundreds of receivers on test, heat soldering irons, run machinery, and light the plant, that it is necessary to run a special power line into the plant from the main Chicago generating system. The power is brought in at 10,000 volts (100 times the voltage of a house lighting circuit) and is stepped down by transformers capable of handling as much as a thousand kilowatts for use about the factory at various voltages as low as six volts, and sometimes as low as $1\frac{1}{2}$ volts. The heavy copper line bars which are used in the transformer station to carry current can handle as high as 10,000 amperes apiece, and are, as you can imagine, heavily guarded with safety devices and warning signs.

Now let's begin our actual investigation into manufacture by stopping in at the receiving department, where all raw materials are received. This department receives the raw materials which go into the radio set—many small parts—nuts, bolts, screws, lugs, queer little pieces of metal, tubes, wire, condensers, knobs, pointers, speakers, magnets — thousands of them! The department handles on an average of 150,000 major parts a day, not counting the most minute parts which come in gross, box, and barrel lots. Special types of scales and measuring machines count and tally the parts.

Once the raw materials have been received and counted, they are sent to the raw material inspection division where is determined which shall be kept and which rejected. Major parts all receive individual inspection. You will meet that word "inspection"



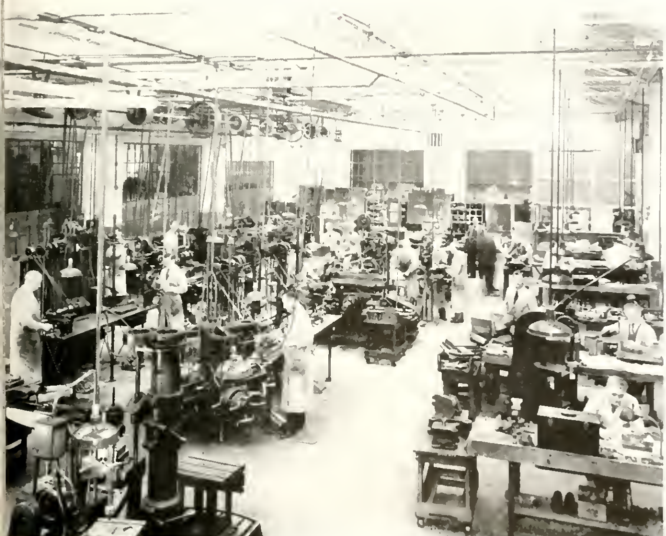
The yacht "Mizpah," floating home and experimental laboratory of Commander E. F. McDonald, Jr., President, Zenith Radio Corporation.

many times before we have finished. The cost of inspecting some of these parts is higher than the price paid for them, yet, the inspections save much grief later on, when the part has been incorporated into the radio. Inspectors at this early stage are chosen for their ability to concentrate on detail. One defective part that finds its way into a completed radio set can cause incalculable expense in the rechecking that is then necessary; hence, the application of the good old rule "an ounce of prevention is worth a pound of cure." Here again, testing equipment is specially designed in the factory's own machine shop and engineering laboratories.

If the raw materials survive all the rigorous tests applied to them, they are given temporary rest in a mammoth stock room where they are labeled and made ready for their departure to the production lines. This journey to the lines they make during the night hours. Each part is placed in a container before the stations of the respective operatives. Thus, when the employes arrive in the morning, the long line tables, some of them long enough to accommodate as many as two hundred operatives in a single line, are "loaded for bear," so to speak.

Let us leave the main lines for a few moments and go into the coil winding department, where hundreds of operatives are at work preparing the little coils of various types which are so essential to the operation of a radio. It is not our purpose to describe the technical function of each part that goes into a radio. That would necessitate an essay on radio engineering, which is a department in itself.

It takes a woman's touch to handle the fine sizes of wire that go into the making of radio coils.—the "brains" of a radio set.



In this machine shop, artisans of many years' experience prepare the dies used in the manufacture of modern radio sets.

Coils should really be called "the brains of the radio," for they are the first to pick up the radio waves transmitted by radio stations, to send them through the intricacies of a radio receiver, and to reproduce them into sound. The function of a radio is indeed to seize upon the infinitesimal spark of electrical power that comes through the atmosphere, and, little by little, to build it up electrically, through the introduction of local electrical power which is provided by your lamp socket. This power, built from a tiny impulse, is eventually strong enough to actuate mechanical machinery which interprets it into sound. Think of a microscope which enables you to see the smallest microcosms invisible to the naked eye, much magnified, and you have an analogous picture.

Radio coils are small things, like most components of a radio. They must be correctly wound to a precise number of turns; they must be made moisture proof to withstand various conditions in various countries and homes.

The cores of the coils, which are made of vegetable paper, are cut to size, thoroughly dehydrated in an oven, then impregnated with wax under heat and pressure. Cores then go to the coil winders who place them on revolving mandrels and wind the correct number of coils of the proper sizes of wire on each coil. Another

The radio chasses pursue their journey down the "main line." This is one of eight similar lines. Each operator adds one or two vital small parts.

inspection follows, during which, among other things, each coil is checked for inductance on "Wheatstone Bridges" energized from one thousand cycles of audio current. The coils are next balanced against a resistor to a point where every winding on like coils represents an identical value.

Next, the wound coils get a painting of lacquer of high insulating quality, which secures the turns of wire in place. Once again the completed coil is dipped in a wax bath to keep out moisture which might change its efficiency.

On observing the tremendous amounts of wire that are used in coils, and in the entire radio set, one might well ask why they are called wireless sets. Believe it or not, the average radio or "wireless" set contains two miles of wire!

Now, having touched on coils, let's travel over to the machine shop, where we'll see the actual chassis bases being prepared for use in the production lines. We'll get back to that line after a little while.

To be converted into chassis bases, sheet steel goes through a rapid and almost magical transformation. Long sheets of steel less than an eighth of inch thick go through the hungry maw of a steel cutting machine, and pieces of steel of the required length for the various radio models are neatly sheared off. The pieces are then fed to giant, one-hundred-ton punch presses which in one fell swoop punch out all the holes required for the wiring and placing of tubes and parts in the chassis.

Next the punched steel sheets are sent to the forming press where special dies mold them into the box-like shape that forms the chassis. After this, the two end pieces are spot welded on to this form, making a complete metal box, full of holes and without a cover, so to speak.

Our chassis now proceeds to a bank of riveting machines, which rivet the tube sockets to the boxes. A serial number is stamped right into the metal of each chassis at this point, and this number identifies the chassis for the remainder of its useful life, no matter where it goes. Our "fingerprinted" chassis bases are now placed at the heads of the actual production lines, ready to receive, one by one, the parts which have been laid out for them on the long line benches.

We're getting nearer to that line we left a while ago, but let's digress for one moment more and visit the tool and die department where all tools and dies required in the manufacture of the radio sets are made, and in many cases invented. Many of the dies are worth thousands of dollars. To machine a die for proper use in radio work, one must take calibrations within a thousandth of an inch.

Now at last we're back at the head of the production line. Chassis, coils, and small parts have all been prepared and laid out. The chassis, bare of everything except tube sockets, begins to move down the long line of operatives, who are mostly women. Their feminine fingers are particularly adapted to this type of work, for it's fine work, almost to be compared with needlework, although done with wire and metal. The women, carefully trained, place the parts in the chassis one by one, and as the chassis slides along, it begins to blossom with more and more wires, lugs, coils, condensers, tubes, and controls. Each operative performs one operation, and

From the "main lines" the chasses go to a battery of radio electrical inspectors

Overhead mono-rail conveyor takes chasses to join their loud speakers.

ımetimes two, but never more. Each orker knows intimately the one spot the chassis to which it is her duty minister, but if you were to ask any them to build you a complete radio t, the Lord help you!—for they ouldn't know! The only people in ie entire factory who could build you complete radio set, and who have, fact, completely built every model dio upon which production is based, e the research and service engineers ho hold forth in the laboratory—a rge department in itself.

And so as we watch the workers, e see one placing a condenser into osition, another placing small nuts proper bolts, still another bolting e condenser into place, another acing a wire, her companion secur- g it with a minute piece of melting lder. This goes on through several indred people until the chassis slides it of the end of the production line ll of its "works," complete with al, pointers, controls, tubes, etc.

No motorized conveyors are used on e production bench. The product is ot driven past the operative, but each orker is given the time needed to rform the operation demanded with ie care. Each operation is carefully lculated to take about the same time any other operation, so the set al- ays moves smoothly along, being ven a gentle push to the next orker, after one has finished.

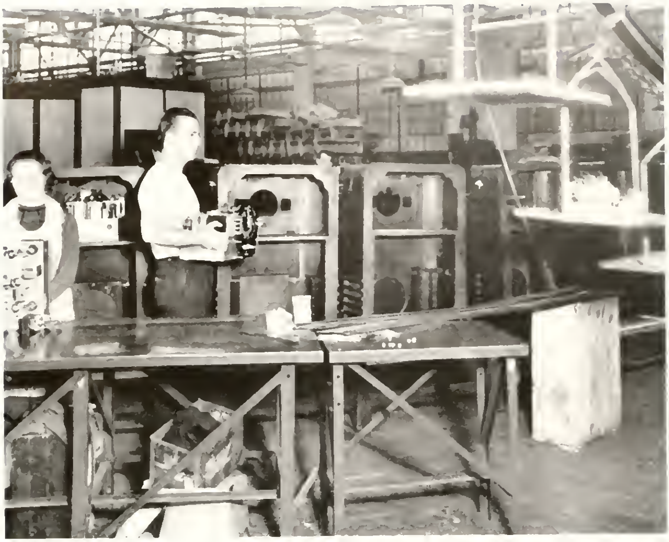
Inspection plays a big part here, as does throughout the entire process manufacture. Every fourth oper- ive is also an inspector whose duty is to catch errors in process along e line. In this way, errors are picked up before they become really difficult to correct. In fact, everywhere in the factory you will hear the phrase: "Discover mistakes in the factory, lest they find their way into the customers' homes."

The complete chassis, which has just received all this attention, now still lacks a cabinet and a speaker. Before it is joined to these, it filters through a series of terrific electrical inspections and tests. From the hands of a long row of women, it now goes into the hands of a long row of men, who do various things to it. They make a mechanical check-up of all wiring, to see that wires go to and from the correct points. All soldered points are checked for connection. Electrical inspection engineers, sitting on a raised wooden floor, screened with wire mesh beneath it in order to cut out electrical disturbances, check the set for electrical functioning.

Each electrical inspector sits with earphones on his head, measuring the sensitivity or pulling power of the set, and the selectivity or station-selecting power. These must come up to a set of rigid standards. Broadcast signals for this purpose are supplied to the examining inspectors from the factory's own signal generators which deliver 5,000 milliwatts to concentric transmission lines. These in turn convey the energy to the test positions. Generators are held to within five hundredths of one per cent in accuracy. All the frequencies on which the set is later to operate in the home are used on these test positions from 175 kilocycles to 30 megacycles.

The use of controlled transmitted

Radio chasses ride the "scenic railway" —receiving the rough and tumble "bump test" as they finish the ride. They are now ready for speakers and cabinets.



Here the chasses are placed in their proper cabinets.

signals gives a much more accurate check on the electrical qualifications of the receiver than would the use of actual broadcast and short wave signals at this stage of inspection.

The electrical tests are possibly the most important to which the receiver will be subjected. For that reason they are numerous, and are carefully made. Right at this point, even with all the preceding inspections, 20 per cent of the receivers fail to make the grade, and are sent back to repair benches for the individual attention of repair engineers. Mistakes are marked plainly, and a record of mistakes in each department is kept so that they may be eliminated as manufacture proceeds. In this way, rejection percentage is slowly but surely reduced as any particular chassis continues to run. Once a chassis has passed the electrical inspectors, its "insides" are "O. K.", and it is safe to say it will give long and satisfactory service to its purchaser.

We're not through with this chassis, however. It now gets the "bump test." It is roughly forced to slide down a curved chute full of ridges which jiggle it so hard that any loose connections previously overlooked surely show up. This test is designed to duplicate some of the transit handling that a radio is likely to receive on its journey from factory to distributor to dealer to consumer.

All survivors of the bump test are placed on a chain conveyor carrying trays full of chasses. Round and round the factory goes this conveyor, carrying chasses to points where they are needed. It is more than 1,100 feet long, and travels at the rather lazy pace of 15 feet per minute. At intervals you will discover dips in it that bring the chasses down to within shoulder height, so that workers may remove them for further attention.

This further attention is given in the cabinet division where the chassis is placed in its acoustically matched cabinet, and the loud speakers are added, secured and electrically connected. Now for the first time the radio has been equipped with a voice and may be heard without the use of earphones. So it is promptly sent to a long row of booths where it is actually played on a great number of broadcast and short wave stations. In other words, it gets a complete going-over under actual broadcast conditions.

In spite of the many checks and tests which the poor radio has received, we find that 10 per cent are again subject to corrections of various kinds at this point in manufacture in order that they may adhere to the high standards required.

Well, let's assume our much-inspected and tested radio has survived thus far—and if it has survived we know it had to be good to get by. It now receives a final caressing. Furniture craftsmen take it in hand, and give its cabinet a strenuous and complete beauty treatment. Any little blemishes that may not have been caught before the cabinet joined its chassis are searched for and wiped out, and the cabinet is polished until it glistens.

Furniture craftsmen putting the finishing touches and polish on the completed radio.

The set is now ready to go to the shipping department to be placed in a carton and marked for destination. The set leaves the factory via its own railroad and truck shipping platforms, by every known means of transportation. Many leave on long, heavily laden freight trains, some to be transshipped on ocean and lake freighters. Others go direct by truck, and still others are placed in the hands of express messengers who hurry them off to waiting airplanes. This latter method is used many times when samples must be placed quickly into the hands of distributors for conventions and showings.

Looking at radio manufacture objectively, one might be tempted to think of it as common, every day mass production. Viewed in its larger aspects, it is not untinged with romance. Radio constitutes a powerful influence in modern life. The radio unit whose vicissitudes we have just been following will spread pleasure, entertainment, and instruction among millions. The short wave band will bring the listener messages from foreign lands. By their spoken pronouncements he is able to judge for himself men like Stalin, Hitler, Mussolini, Chamberlain, Daladier. The greatest music of opera and concert are his by command. The late war scare revealed how realistic world events can become via radio. To radio is even credited in part the peaceful solution, for a time, of a war-provoking crisis.

We have said little about the human element in the manufacture of radio; yet it plays an important part.

The long shipping platform. A train of freight cars in process of loading.

The finished product meets the exacting requirements of Commander E. F. McDonald, Jr., President of the Zenith Radio Corporation.

Happy workers produce better goods, and this is recognized in radio manufacture. Good conditions of light, heat, and air prevail. Large windows and skylights admit sunlight; correctly installed lights function when daylight falls short. Safety devices encircle all moving machinery. Air is changed frequently by modern conditioning devices. Frequent rest periods interrupt the working day. Lunch and rest rooms are strategically placed throughout the factory. A complete cafeteria serves anything from a sandwich to a substantial meal. A trained safety engineer constantly tours the factory looking for the causes of accidents that may have happened and seeking out potential causes. He wages a daily accident-prevention battle. A doctor and two nurses staff a well-appointed first-aid room and hospital to which the employe is urged to report when indisposed.

Naturally, superimposed upon the manufacturing structure are the administrative, selling, promotion, advertising, accounting, and engineering operations, which are beyond the scope of this tour. That is another story that can be told another time. Engineers must look years ahead, must think in terms of competitors' goods, as must sales management. Experimentation is continuous, resulting in constant improvement of the product. Even minor improvements are never overlooked. Radio, with its habit of introducing yearly models, must make each year's "radio line" a little better than the preceding year's, and does it, too.

H. T. Heald

PRESIDENT HEALD ANNOUNCES GIFT FROM MRS. J. OGDEN ARMOUR AT BANQUET HONORING MIES VAN DER ROHE

MR. CHAIRMAN, Professor Mies van der Rohe, distinguished guests, ladies and gentlemen,

A school of architecture was organized by the Art Institute of Chicago in 1889. In 1893 Dr. Frank Gunsaulus, President of the newly organized Armour Institute of Technology, attended a special meeting of the Trustees of the Art Institute, and stated that Armour Institute would like to establish a thorough course of Architectural Drawing and Designing but did not wish to do so if the Art Institute intended to maintain a thorough and well equipped school in these branches. A special committee of the Art Institute trustees recommended the continuation of the Architectural school under the joint management of the Art Institute and Armour, and the trustees authorized the establishment of the Chicago School of Architecture under this joint sponsorship.

The School was organized as recommended, and continued to operate on this basis until 1904 when Armour Institute of Technology assumed complete responsibility for the management and financial control of the School. The program has since been continued on this basis, with architectural subjects all taught at the Art Institute and engineering and general subjects given at the main campus of Armour. Free use of Art Institute museum and libraries has always been granted to the students of the architectural school, and the Art Institute has continued to cooperate in every way to make the school as successful as possible.

Records show that the first class of two students was graduated in 1898, and that in the following forty years more, 400 students received the degree in architecture. Many of these graduates have won national reputations in their chosen field and are in no small way responsible for the development of midwestern architecture.

In 1936, when Professor Earl H. Reed resigned as Director of the Department of Architecture, an Advisory Committee on Architecture, consisting of prominent Chicago architects, was formed. This Committee, which was made up of John A. Holabird, of Holabird and Root, Chairman; Alfred S. Alschuler, of Alfred S. Alschuler, Inc.; C. Herrick Hammond, of Burnham and Hammond, Inc.; Jerrold Loebl, of Loebl and Schlossman; and Alfred Shaw, of Shaw, Naess, and Murphy, carefully studied the problem of developing at Armour a school of architecture of outstanding merit, and recommended the appointment of Ludwig Mies van der Rohe, world famous modern architect as director of the Department. The negotiations with Professor Mies van der Rohe, begun almost two years ago, resulted in his acceptance of the position, and on September 1, 1938, he joined the staff of the Institute, and assumed the direction of the Department. In the interim, the Department was effectively operated by Jerrold Loebl as Acting Director. Assisting Professor van der Rohe in the development of the School of Architecture are Mr. Ludwig Hilberseimer, Professor of City Planning; Mr. Walter Peterhans, Professor of Visual Training; and Mr. John B. Rodgers, Assistant Professor of Architectural Design. These staff members, together with members of the former staff of the Department of Architecture, greatly strengthen the educational program in this field, and there is every reason to believe that this Department will develop into an outstanding school of architecture, and make a very significant contribution to architectural education in America.

The story of this most recent development in architectural education at Armour would not be complete without giving recognition for the generous financial contribution which makes the new program possible. It is now my very great pleasure to make the first public announcement of a gift of $50,000 for this work by one of Chicago's leading citizens, gracious lady, and long-time friend of the Institute, Mrs. Ogden Armour.

H. T. HEALD

MIES VAN DER ROHE'S ADDRESS, DELIVERED AT BANQUET HELD IN HIS HONOR

Professor Ludwig Mies van der Rohe.

ANY education must be directed, first of all, towards the practical side of life. But if one may speak of real education, then it must go farther and reach the personal sphere and lead to a moulding of the human being.

The first aim should be to qualify the person to maintain himself in everyday life. It is to equip him with the necessary knowledge and ability for this purpose. The second aim is directed towards a formation of the personality. It should qualify him to make the right use of his knowledge and ability.

Genuine education is aimed not only towards specific ends but also towards an appreciation of values. Our aims are bound up with the special structure of our epoch. Values, on the contrary, are anchored in the spiritual destination of mankind. The ends, towards which we strive, determine the character of our civilization, while the values we set determine our cultural level.

Although aspirations and values are of different nature and of different origin, they are actually closely associated. For our standards of value are related to our aspirations, and our aspirations obtain their meaning from these values.

Both of these concepts are necessary to establish full human existence. The one assures the person his vital existence, but it is only the other that makes his spiritual existence possible.

Just as these propositions have a validity for all human conduct, even for the slightest differentiation of value, so are they that much more binding in the realm of architecture. Architecture is rooted with its simplest forms entirely in the useful, but it extends over all the degrees of value into the highest sphere of spiritual existence, into the sphere of the significant: the realm of pure art.

Every architectural education must take account of this circumstance if it is to achieve its goal. It must take account of this organic relationship. It can, in reality, be nothing other than an active unfolding of all these relationships and interrelationships. It should make plain, step by step, what is possible, what is necessary, and what is significant.

If education has any sense whatever, then it is to form character and develop insight. It must lead us out of the irresponsibility of opinion into the responsibility of insight, judgment, and understanding; it must lead us out of the realm of chance and arbitrariness into the clear light of intellectual order.

Therefore we guide our students over the disciplinary road from material through function to form.

We are determined to lead them into the wholesome world of primal buildings, where every axe stroke meant something and where every chisel cut was a veritable statement. Where does the structural fabric of a building appear with greater clarity than in the wood buildings of our forefathers. Where else is there an equal unity of material, construction, and form. Here lies concealed the wisdom of the entire race. What a sense for the material, and what a power of expression these buildings proclaim. What warmth they radiate and how beautiful they are.

In stone buildings we find the same. What natural feeling is expressed by them. What clear understanding for material, what sureness in its use, what a sense for that which can and should be done in stone. Where else do we find such richness of structure. Where do we find more healthy strength and greater natural beauty than here. With what self evident clarity a beamed ceiling rests on these old stone walls, and with what feeling one cut a door in them.

Where else should young architects grow up than in the fresh air of this wholesome world, and where else should they learn to work simply and prudently than with these unknown masters.

Brick is another schoolmaster. How clever is this small, handy unit, useful as it is for every purpose. What logic its bonding shows; what liveliness its jointing. What richness the simplest wall surface possesses, yet what discipline this material imposes.

Thus each material possesses its special qualities which one must know in order to be able to work with them.

That is also true of steel and concrete. We expect absolutely nothing from the materials in themselves, but only through our right use of them.

Then, too, the new materials do not insure superiority. Any material is only worth that which we make out of it.

Just as we are determined to know materials, so are we determined to know the nature of the purposes for which we build. We will analyze them clearly. We are determined to know what their content is; wherein a

(Turn to page 24)

FIRST AERIAL TRAMWAY IN NORTH AMERICA

by
Walter Hendricks

WHEN I think of the ways in which man moves about or is moved about by others, I am filled with amazement.

Starting out on hands and knees, we soon acquired confidence and stepped forth on two feet in search of adventure. Developing boldness, we slid down the cellar door; and adding a degree of daring, we reversed the process and slid down the bannister.

To visit our grandmother, we had to take a cable car, that almost jolted us out of our seat; and to reach our new home on the outskirts of the city, we had to sit and doze in a stuffy car drawn by horses.

As boys we went once, for a reward, to an amusement park and rode on a roller coaster, hanging on for dear life, and dived down an inclined chute in a flat-bottomed boat, which struck the water with a thud and then skimmed over the surface to shore.

View at Cannon Mountain near Franconia, New Hampshire, up the slope of which the first aerial passenger tramway in North America has been constructed. Only three towers, in addition to the terminal anchorages, are required to support the cables. Arrow indicates position of first tower

In spring the ditches would fill with water, sometimes flooding the low lands of the prairies, and then we would build a raft out of planks we had pried from the wooden sidewalks and go sailing off to the ends of the earth, down Martian canals.

Unbeknown to our parents, or much to their concern, we would strip our young bodies of clothes, which we hung on the lower branches of a willow, and learn to propel ourselves about in the amber liquid of a clay hole.

In winter we clamped on skates and raced up and down the frozen ditches and we made sleds and skis to ride and slide over the crusted snow.

Soon came the civilizing sewers which drained the ditches and deprived us of our sailing and skating but along came concrete walks in place of the planks, and we learned to skate on little steel wagons.

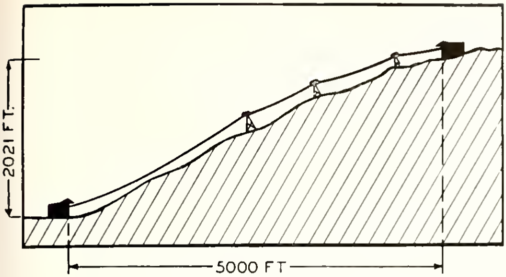
Horses in a city were not the rarity they now are, and we all knew wagons of many sorts, including dumpcarts and most of us rode bareback on some bundle of bones, and a few of us, the elect, risked the ridged back of a race horse.

All this time technological progress was going on about us unobserved, until one day we saw the car tracks extended, a wire strung between them overhead; and soon we had the thrill of riding in a car that moved without horses, but by means of an invisible something called electricity.

And soon came the experience above all others, of riding on a railroad train—even though it was only a distance of perhaps fifteen miles, to a Methodist campground.

Then came the automobile, an astonishing vehicle, which we piled into from the rear, and which chug chugged down the macadam pavement faster than a horse could trot. Now it has become such a commonplace thing and so necessary a part of the life of most of us, that many of us can speak of having driven one a distance of a dozen times around the earth.

And then came the War—and ap



Elevation showing relative position of terminal stations and cable-supporting towers

parently not "the war to end all war." and with it, for me, for the next few years, the piloting of an airplane.

It was my fortune, subsequently, to go down under the sea in a submarine, to ride upon the surface of the sea in all manner of boats, and to travel on the sea and through the air in a hydroplane, besides piloting airplanes.

I am almost impressed with the ways in which I have moved about, and could almost think of myself as some kind of authority on locomotion, if it weren't for the fact that most of us have had pretty much the same experience.

But there is one ride that is new, at least, in North America—the Aerial Passenger Tramway of Cannon Mountain in the Franconia Notch of the White Mountains in New Hampshire. Compared with all the others, it seemed to me to be at once the most thrilling and delightful. Possibly it was because the day was clear and the visibility excellent, and because I was in good company, and because of all the associations surrounding this very spot. These were the first mountains I had ever seen. A teacher of mine, a great poet, a fine friend, showed them to me years ago. There they stood, across the valley, in front of his house, as if they were his. On my first visit, we waited a week for them to clear, but the clouds persisted in half veiling the peaks. But on my second visit we climbed this very mountain, with two of his children, the first mountain I ever sealed, and were caught in a snowstorm, which we thought for a time would do us harm.

It took us hours to climb it, but today you may "float through the air with the greatest of ease," and get to the top in five minutes and twenty-eight seconds.

Now, perhaps, it will interest you to learn that this mechanical way of climbing mountains is not European, but indeed American: for it was none other than Sylvester Marsh who, revisiting New Hampshire, his native state, in 1852, conceived the idea of a mountain railway while he struggled with a friend to reach the top of Mt. Washington during a fog.

When he first presented to the New Hampshire legislature his plan for building a railway up Mt. Washington he was laughed at, one of the representatives calling his plan "a wild dream of a crazy inventor," and another ridiculing the idea, saying, "Why stop this railroad at the summit of the mountain? Let's give authority for its extension to the moon."

But Marsh won out, the cog railway was built, and it has been running since 1858, now eighty years, without injury to a single passenger; and it is still regarded as a great feat of railroad construction.

The charter which Mr. Marsh obtained included also the right to build a second railway up Mt. Lafayette,

Close-up view of one of the three giant steel towers which support the cables

The Valley Station, containing ticket office, waiting room, and the main control room from which the operation of the tramway is controlled

across from Mt. Cannon, but this project was never undertaken.

As soon as skeptics were convinced and the railroad was operating successfully, an engineer came from Switzerland and tried to persuade Mr. Marsh to build a similar system up the Rigi, but Marsh refused, at the same time placing his drawings and models at the disposal of the visitor and explaining them to him in detail. He might have taken out foreign patents, but he chose rather to give away his invention to any who could make use of it, and he was happy to have the engineer return to Switzerland and build the Rigi railway himself.

About 1874, in Europe, the cog railway was displaced by the aerial tramway. Of the more than seventy tramways which have been constructed in Central Europe and in South America, more than fifty of them have been built since 1912. And now in North America we may expect to see a number of them springing up, plans having already been made for Mt. Hood, Mt. Baldy, and Mt. Ranier on the Pacific coast, and Mt. Mansfield in Vermont.

The credit for the first North American aerial passenger tramway, on Mt. Cannon, goes to Mr. Alexander Bright, of Boston, a member of the United States Olympic ski team of 1933.

Switzerland had come to America for the idea of the cog railway; so we went to Switzerland for the idea of the aerial passenger tramway.

It was in 1930 that Mr. Bright made his first visit to St. Moritz, the international center for winter sports. Here he saw skiers using the tramway to get to the top of the ski run, instead of climbing back on foot. At first he laughed at them and called them weaklings; but soon having tried the tramway, he changed his mind and became enthusiastic about it, and upon his return from the Olympics in 1933, he sought the assistance of the American Steel and Wire Company in making preliminary surveys for the construction of a tramway in America.

Friends who went each winter to the White Mountains to ski scoffed at his proposal, and the New Hampshire legislature treated it in somewhat the same manner as an earlier legislature had considered Marsh's plans for the cog railway up Mt. Washington.

But slowly, surely, Mr. Bright worked toward the fulfillment of his plans. In November, 1933, a survey was made; in December of the same year, an estimate of the cost of construction was drawn up, and an examination made of the operating costs and possible returns; in the Spring of 1934, careful inspections were made of other possible locations, resulting in the unanimous approval of Mt. Cannon because of its accessibility; in June, 1935, the United States House of Representatives passed a bill approving the proposed tramway, under a provision calling for Federal financing by the Public Works Administration. But complications developed and Federal aid was withheld. Again the project might have lapsed but for the determination of Mr. Bright and the enlarging circle of his friends and supporters, among them Mr. James C. MacLeod of Littleton, Mr. L. R. Bateman of the American Steel and Wire Company, and Mr. Roland E. Peabody of Franconia.

In October, 1936, a new bill, calling for an appropriation of a quarter of a million dollars of State funds, was prepared; and in June, 1937, this bill was finally passed, with the support of Governor F. P. Murphy, who appointed a commission to direct the project. On August 16, bids were called for; and ten days later the

The control room, showing the operator's desk and control equipment used in operating the tramway

Mountain side of Valley Station. Note supporting and operating cables, also tram-car in its terminal position within the station

contract was awarded to the American Steel and Wire Company, construction to be started at once and completed within 150 days.

A C.C.C. camp had been established at North Woodstock under the charge of the State Forestry Department. Boys from this camp constructed large parking areas, various ski trails, and ski practice areas.

On June 28, 1938, the tramway was officially opened, and Alexander Bright rode up victoriously as one of the first passengers. Since that date the tramway has done a "land office" business, carrying more people in the subsequent 72 days than any other tramway in the world has carried in a year.

The location of Cannon Mountain, upon which the tramway is built, is familiar to millions of Americans and to thousands of foreigners, because of that very remarkable stone formation called "The Old Man of the Mountain," or as Hawthorne named it, "The Great Stone Face."

Known to Indians and settlers alike, this stone face has become a symbol of courage and character; and many have traveled thousands of miles merely to look at it.

Only a half mile to the north on another side of this same mountain the tramway is located. Both are on the same highway, U. S. 3, which runs through the heart of the state. Here we may leave our car in one of the excellent parking areas built by the Civilian Conservation Corps.

The building we are approaching is the Valley Station, situated at the foot of the tramway. It contains the conventional waiting room with the customary counters and souvenirs. But here, too, is the ticket office; and unless one has come very early one must sit and wait one's turn; or he may go outside and look at the tramway in operation, and a public announcer will keep him informed if he has wandered off to admire the natural scenery of the vicinity.

Within this same building is also found the control room, which is directly in line with the ascending and descending cars. Here sits the operator controling the movement of the system. Safety is implicit in everything. The operator must use both hand and foot to start the cars and to keep them moving. Even so, the conductors of the two cars may also exercise control, if the necessity for such action should ever arise; and the cars and stations are equipped with telephone; so the conductors and the operator may telephone to one another at any moment.

Admitted to the loading platform, the twenty-seven passengers enter the car that has settled to rest. The cars are twelve-sided, and carefully designed and fabricated to give maximum safety with minimum weight. The upper part of each of the twelve sides is equipped with a transparent, non-breakable material, fitted into sashes, three of which, at each end of the car, are removable. Hatches are provided in the roof and in the floor for access to the carriage above or the ground below, in case such openings should be required.

The cars are suspended on an eight-wheel carriage which runs along a fixed traction cable of locked coil construction and special high strength grade, used with marked success at Madden, Boulder, and Norris dams, and other large construction projects in the United States, and on several heavy-duty freight tramways.

Each track cable is wound five times around a large drum, built into the construction of the Mountain Station, and securely anchored. At the Valley Station, each cable is connected to a flexible counterweight of 100,000 pounds, which moves up and down, thus equalizing the cable tension at all times.

The cars are pulled by a continuous traction cable, which is attached by means of special sockets to each car and passes around sheaves, or groove-rimmed wheels, of 13-foot diameter, at both the Valley and the Mountain stations. If the traction rope should ever break, heavy springs in the upper framework of the carriage would instantly and automatically hold the car from slipping down the track.

At a given signal the traction rope is set in motion, and both cars move simultaneously, the one up from the Valley Station, the other down from the Mountain.

As our car moves slowly upward we look about at the widening landscape. Over the top of the station rises Eagle Cliff, jagged and rocky, like the ornamentation of a Gothic cathedral. Down in the valley, to the left, lies Echo Lake like a blue egg in a green nest. As we rise and rise, now faster and faster until we are traveling at the rate of a thousand feet a minute, we see Mt. Lafayette rising too, as if it were growing larger and taller than its 5200 feet.

We have passed the first steel tower, and we dip as the cable slackens. Half way up we hail the twin car floating down. The cars move smoothly, vertically like the bob on a plumb line, without swinging or swaying, no matter how strong the wind blows through the Notch, because of dampeners and neutralizers which the engineers have devised to ensure the comfort and pleasure of the passengers. Again we rise for another tower saddle, and dip in the trough, to rise and dip again a third time, before arriving at the Mountain Station where we all disembark.

A short path through the stunted trees leads along the shoulder of the

One of the two tram cars, which have a capacity of twenty-seven passengers. The construction of these cars is such that passengers have an unobstructed view in all directions.

mountain, edging a great ravine, over pyramidal blocks of stones to the summit of the mountain, where from an observation platform one may look out in all directions, 150 miles to the north, into Canada; across farmlands and hills to the Green Mountains of Vermont; down into Massachusetts and Connecticut; and off to the east toward the sea.

Across the Notch stands Lafayette, rocky and treeless on top, a thousand feet taller than Cannon, and the highest peak in the Franconia Range, a mountain I have climbed several times—on foot. The earth spreads out like a Paradise of green in all directions and only man seems vile with all his hatred and his lust for murder.

Green as it is, soon everything will be white. Snow will lie in drifts, ten to twenty feet deep. Then the skiers, for whom the aerial tramway was originally intended, will have their holiday. The experts will shoot zigzag down the sporty Taft trail; amateurs, by the thousands, who will come on special snow-trains from the cities, will slide and jump on the numerous other trails; and growing boys from the surrounding villages will tumble over the practice areas, training to become the champions of the future.

But now it is time to descend. We may stay as long as we like, but we have had our fill of wonder and natural beauty. Next year we shall come and try out some of those intriguing and inviting trails that lead up and down over the mountain range.

Now we enter the car once more. The descent is even more thrilling than the ascent. Too soon we come to rest in the Valley Station where hundreds, it seems thousands, are patiently and insistently waiting their turn to take this most wonderful of rides.

MIES VAN DER ROHE

(From page 19)

dwelling is really different from another kind of building. We want to know what it can be, what it must be, and what it should not be. Therefore, we must get at their essentials. Thus we will examine every function which appears and determine its character and make its character the basis for our conception and our form.

Just as we procure a knowledge of materials—just as we acquaint ourselves with the nature of the uses for which we build, so must we also learn to comprehend the spiritual and intellectual environment in which we find ourselves. That is a prerequisite for proper conduct in the cultural sphere. Here, too, we must know what exists, for we remain dependent upon our epoch.

Therefore we must learn to recognize the sustaining and compelling forces of our times. We must make an analysis of their structure; that is, of the material, the functional, and the intellectual forces of today. We must clarify wherein our epoch is similar to former epochs, and wherein it differs from them.

Here the problem of technology will come within the student's compass. We will try to propound genuine questions; questions on the value and meaning of technology. We will demonstrate that it not only offers us power, and magnitude, but that it also embraces dangers, that it contains good and evil, and that here mankind must decide aright.

Yet every decision leads to a definite clarification of principles and values. Therefore we will elucidate the possible principles of order and clarify their bases.

We will mark the mechanical principle of order as an over emphasis of the materialistic and functional tendency. It does not satisfy our feeling that "the means" is a menial function, nor does it satisfy our interest in dignity and worth.

The idealistic principle of order, on the other hand, can, with its over emphasis on the ideal and the formal, neither satisfy our interest in truth and simplicity, nor the practical side of our intellect.

We will make the organic principle of order clear as a scale for establishing the significance and proportion of the parts and their relation to the whole.

We will adopt this last principle as the basis of our work.

The long road from material through function to form has only one goal: to create order out of the unholy confusion of today. We want, however, an order which gives everything its proper place. We want to give to everything that which is its due, in accordance with its nature.

We are determined to do that in such a perfect way, that the world of our creation begins to flower from within. We want no more—nor can we do more.

Nothing will express the aim and meaning of our work better than the profound words of Thomas Aquinas: "BEAUTY IS THE RADIANCE OF THE TRUTH."

BALL BEARINGS AND THEIR APPLICATION

by

R. P. Petersen

THERE is a little known and little thought of article in extensive ise today which is contributing ;reatly to our present-day machine lesign. It is the ball bearing. Hunlreds of thousands of its counterparts ;o out into use daily in normal times: 'et it performs a hidden duty and so ve think very little about it.

Its function is to broaden the field f usefulness of the wheel in all its nany forms. The wheel, of course, is nan's cleverest and most important nvention. It is the cleverest because t is his one really original invention: he only one he has made all by himelf without copying from nature. It s his most important invention beause present day civilization depends o heavily upon it.

This, then, is the ball bearing's pur-

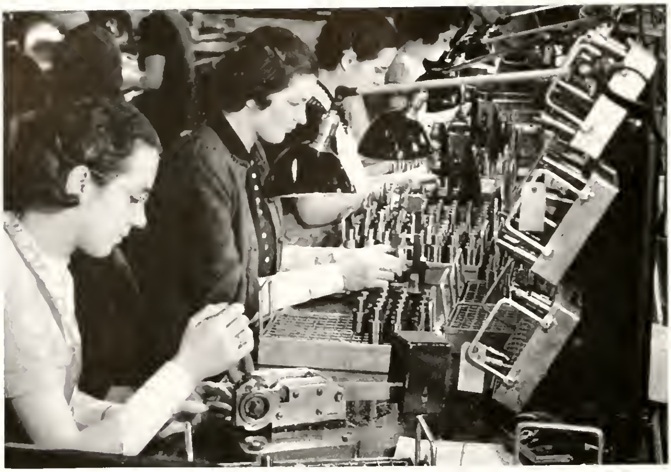
Modern ball bearings—each a complete high grade precision article.

Finished standard balls are selected for size into divisions of .0001 inch on gauging machines of this type. They roll down between bars spaced one one-thousandth of an inch out-of-parallel and drop through at points corresponding to their size.

pose: to help the wheel to do its part more efficiently, smoothly, and accurately. Back in the Stone Age, when the wheel first came into use in the form of a roller applied under a load, the advance over the older method of dragging articles on the ground was great, and further improvements in efficiency were not required.

As civilization advanced, however, more dependence was placed upon the wheel; and more was demanded of it. The wooden wheel and axle first came into being, then the metal axle, and later the metal journal and bearing. Each step added to the efficiency of the wheel and increased its usefulness.

These improvements were still not sufficient, however, to satisfy the demands of progress, and so men turned to more frictionless or "anti friction" types. Leonardo da Vinci, in a note book dated 1490, left sketches of a compound roller device used for a bearing. It consisted of a means of



Inspections! Each bearing undergoes some eighty or ninety thorough formal inspections.

supporting each end of an axle on the circumferences of two large discs or rollers. The shafts of these rollers, in turn, were supported on other rollers whose shafts were again similarly supported. To us, this seems a very complicated arrangement, but it was no doubt effective in reducing friction.

The first practical ball bearings came into use with the bicycle boom of 1868-69. The boom died down in America in 1870 but survived in Europe, and so it is to the Europeans that we owe most of the immediately subsequent development.

It was a German bicycle maker by the name of Fischer who, about 1885, invented the disc method of grinding balls. He had been purchasing separately made balls from England, and they were very expensive. In an effort to reduce costs, he hit upon the method of feedings balls, with oil and emery, into a groove between rotating discs, and was thus able to obtain accurately sized and formed balls at a fraction of the former cost. This added great impetus to ball bearing progress, and this method is substantially the one in use today.

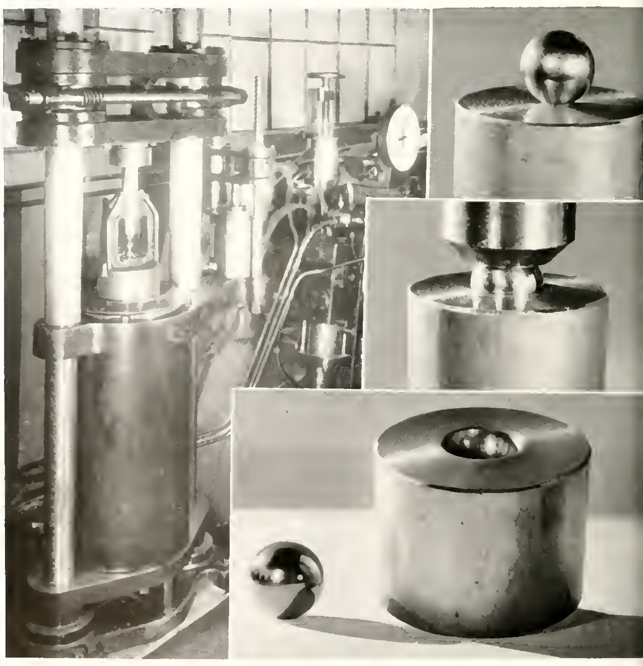
A bit later, in 1898, the German manufacturers got together and commissioned the State Testing Laboratory at Neubabelsberg to have Professor Stribeck conduct researches into the theory of ball bearings. This he did extensively, and evolved certain formulae, many of which are in use today. Until that time there had been much confusion among ball bearing makers as to bearing capacity, life, etc., and Stribeck's researches clarified the situation, formulated the basic principles, and led the way to practical designs.

American advent into this field manufacture is interesting. In t 1880's, we were makers of doorbell and firegongs. Amongst the doorbel was the old familiar form, some which are still in existence, having wound up spring and a push butt which, when operated, produced prolonged "rrrring," giving the effe of "an electrical bell, without the u of batteries."

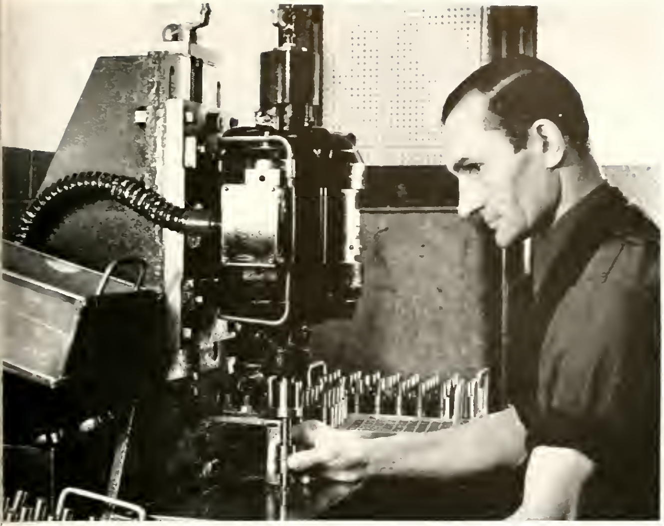
This led to the making of bicyc bells in various and numerous siz and shapes, then bicycle hubs a coaster brakes, and with them, ba bearings. From then on, developme of the ball bearing was rapid, pr gressing along with the developme of, first, the bicycle and then the m torcar, to which it has contributed im mensely, until the art has reached i present highly refined state.

Today, standard run-of-mine bea ings are made to tolerances on the o der of a few ten-thousandths of a inch. The balls used in them are s lected for diameter into .0001 inch d visions and are checked for spherici to .00001 inch. Rings are similar selected, and are matched with corr sponding ball sizes for selective a sembly, producing very accurate fitted bearings.

Numerous more highly refin grades of bearings are also made, u to the "super-precision" class, used high grade machine tool spindles a



Hydraulic machine on which balls are tested, a quantity from each lot, to insure uniform quality. Insets show evidence of the enormous crushing strength of steel balls: a ball pressed into a solid block of steel under a load of 90 tons. The block is swelled and cracked: the ball still round and good for more tests.



Bearings are noise tested while running at full speed, in sound-proof rooms.

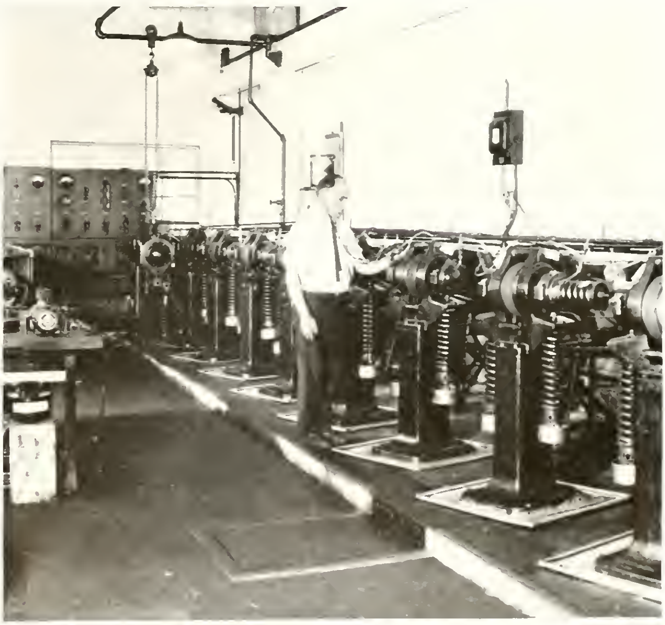
the like. In these, the ball diameters are held to .00001 inch. Bearing bore, outside diameter, and eccentricity tolerances are on the order of one or two ten-thousandths with the high point of the eccentricity marked so that all bearings on a shaft can be lined up the same way to make the runout an absolute minimum.

Balls and rings are made from very meticulously prepared high carbon chrome steel, followed with extreme care through all stages of manufacture at the steel mill and then checked and rechecked by metallurgists and metallographers at the factory. The rings are forged from bars and annealed for machining, the balls are headed from coils or rods and normalized preparatory to rough grinding.

Machining of the rings is done mostly in automatic chucking machines. After hardening, the rings are ground, the grinding of the races being done on oscillating machines, forming the race way curvature very accurately. The races are then lapped to a fine finish.

Rough grinding of the balls is accomplished by a type of special machine in which the balls roll into a groove between a revolving cast iron plate and a grinding wheel whose axes of rotation are offset from each other. As the balls pass through this groove, they are rolled as they are ground, constantly presenting new facets to the wheel. Following one pass, they are carried back to the hopper whence they are returned to the grinding operation. This cycle is repeated for hours, until the balls have been reduced to a suitable size.

Corner of a physical testing laboratory in which hundreds of bearings are under constant tests to destruction in the search for a better product.

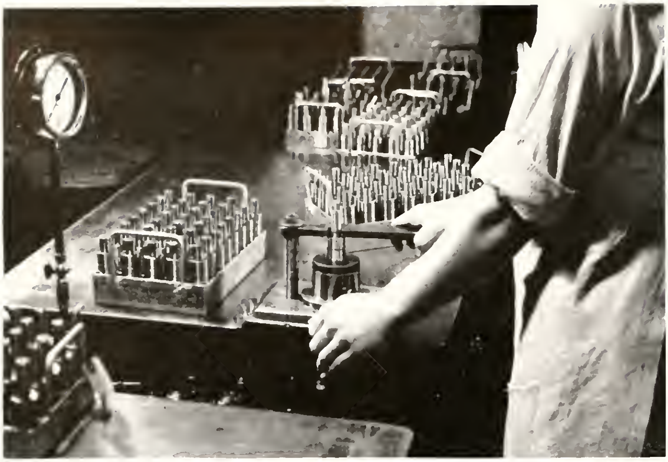


Following this rough grinding operation, the balls are hardened, then finish ground and lapped in progressive stages down to the final size and finish. The lapping operation is very similar to the grinding operation, except that cast iron or bronze plates charged with various grades of abrasives are used in place of the grinding wheel.

Individual inspection of each and every ball is very carefully made in a specially illuminated and air conditioned room. Each trayful of balls receives two complete 100 per cent inspections, and then a percentage inspection in which about one out of every ten is carefully checked over. If a single defective ball is found in the check inspection, the whole batch goes back for re-inspection.

They are then checked for sphericity and selected for diameter. In the selection for diameter, machines feed the balls from hoppers one at a time to roll down between pairs of inclined gauge bars spaced, for standard balls, one thousandth of an inch out-of-parallel. The balls drop through at various points depending upon their size, and are caught in chutes which deliver them to corresponding pans.

Assembly is effected by eccentric displacement of the two rings, which permits most of the balls to be dropped into the raceway grooves. The remaining balls of the complement are readily inserted by a slight



Grease is shot under pressure into grease packed bearings by machines which automatically and accurately gauge the quantity.

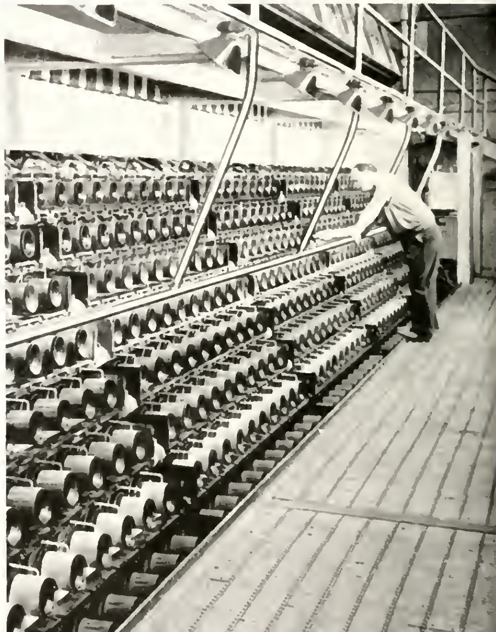
heating or elastic distortion of the outer ring, or both as may be required, neither of which is great enough to produce any permanent effect. The balls are then slipped into proper spacing and the separator installed.

After careful cleaning, each bearing is noise tested in a sound-proof room. This is one of the very numerous inpection operations. Each bearing undergoes some eighty or ninety th rough formal inspections. The outside and inside diameters are checked for size; the end play is measured; concentricity and face-trueness are carefully checked; and so on.

They are then slushed with an oil which protects them from rusting until they are installed, and also acts as the initial lubricant. Bearings which are sealed for life or grease packed receive their charge of lubricant at this point.

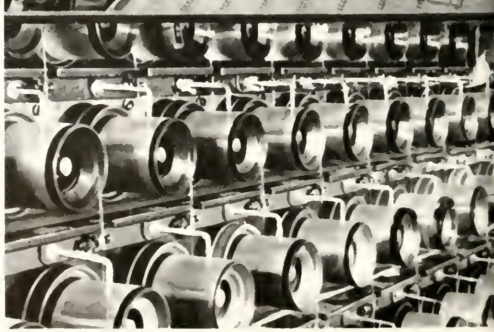
The grease used in grease packed bearings is a very special one developed under the control of the laboratory, and obviously must be such as not to break down or deteriorate over a long period of time and yet have lubricating qualities suitable for ball bearings. Its contribution to modern design is substantial because it facilitates the use and extends the life of bearings in places where lubrication is difficult or the bearing inaccessible; where grease or oil spillage is objectionable; where the bearing is required to operate under dirty conditions; where it is likely to be neglected; and so on.

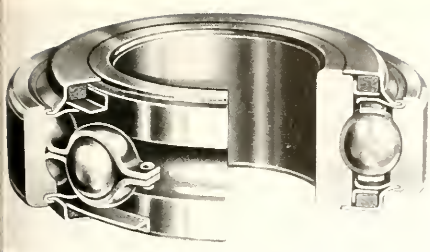
Grease packed bearings are used extensively in such places as vacuum



Banks of reels at the new Painesville, Ohio, plant of Industrial Rayon Corporation. The grease packed feature of the 300,000 ball bearings used in these reels eliminates what would otherwise be a tremendous lubrication task.

Reels used in a new continuous rayon spinning process. he thread advances along the reel as it revolves. Satisfactory operation depends upon accurate positioning of the revolving parts, carried on ball bearings.





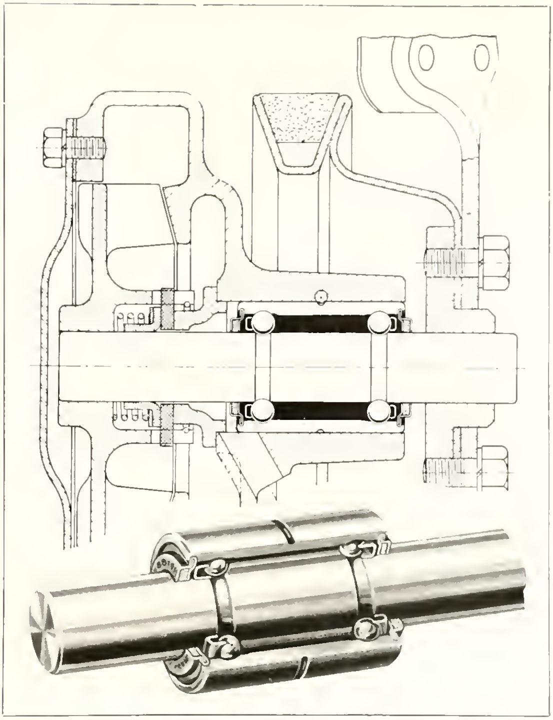
A modern grease packed and sealed-for-life ball bearing. This particular model is used for automobile rear wheels, and eliminates lubrication there.

cleaners, washing machines, electric motors of all types, pumps, conveyors, industrial cars, and other devices and machinery of all kinds. An outstanding example of their modern application is in the reels and spindles of a new continuous-process rayon spinning machine. In one plant, about 100,000 reels and 10,000 spindles will turn over on more than 300,000 grease packed ball bearings which will require no other attention than that resulting from ordinary periodic inspection and maintenance.

Grease packed ball bearings are one of the items which made this continuous spinning machinery commercially possible. The use of ball bearings served to provide accurate and permanent location of the reel parts, so necessary to their satisfactory functioning, and lowered the power requirements and thereby effectually helped to reduce the total weight of machinery. The grease packed feature eliminated the necessity of provisions for oiling or attention in service, which would have been a difficult problem and an expensive maintenance operation. In the twister spindles, which operate at 8,000 to 10,000 r.p.m., they have in addition simplified the design and greatly reduced the cost.

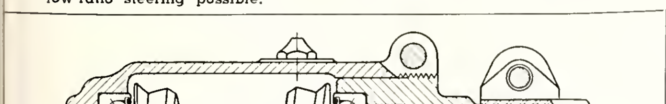
It is safe to say the modern motor car would not be what it is today without ball bearings. Sealed-for-life bearings are used on rear wheels and propeller shafts. The packless water pump was made practical by the use of sealed ball bearings which require no attention either for adjustment or lubrication and which help the disc type water seal to function by keeping it accurately in place.

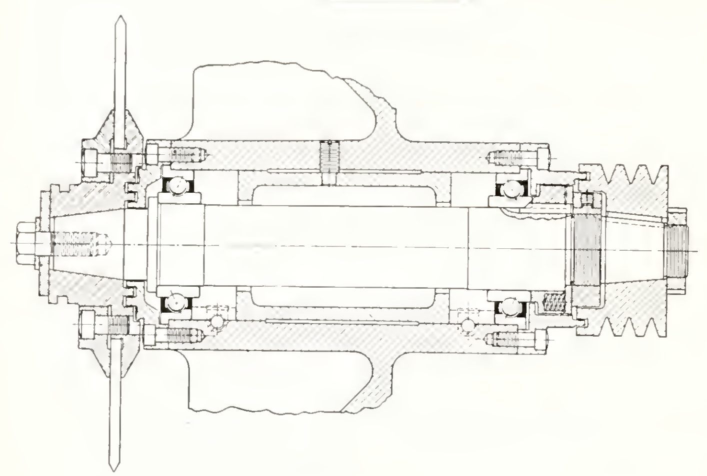
In addition, ball bearings are used in the transmission, at the rear pinion, in the generator, etc. Particularly interesting is their application to the



Automotive fan and waterpump shaft and typical assembly, which requires no attention for either adjustment or lubrication.

Ball bearing roller tooth for automotive steering gear. Rolling motion is substituted for the sliding friction of ordinary gear teeth, making easy low-ratio steering possible.





steering gear where they have pro duced easy low ratio steering b means of the ball bearing roller tootl which substitutes rolling friction fo the sliding friction of ordinary gea teeth.

Romance enters into their use in th gyro compasses and "Metal Mikes' which now pilot our ships at sea. An certainly they have reached new fron tiers in their application to machin tool spindles where they do fine an precise work efficiently at speeds u to 60,000 r.p.m.!

These, then, are some of the way in which the ball bearing has helpe man to make constantly more and bet ter uses of his age-old invention, th wheel.

High speed precision grinder spindl mounted on preloaded flanged super-pre cision ball bearings.

KETTERING

(From page 11)

"No, we have been pretty well over the ground."

"That is true, but you still don't know anything about it. Let's start right here." I rubbed my hands together. I said, "My hands get warm when I rub them together. Why is that?"

"That is simple. That is on account of friction."

I said, "What is friction?" After an hour and a half discussion we came to the conclusion that friction is the thing that makes your hands warm when you rub them together.

Your chairman asked me a while ago if I had found the answer to why you can see through a pane of glass. You may know my story about that. I had a group of very great physicists in my office one time, and they said, "Why do you worry about modern physics? There is no question in the world that we cannot answer for you."

"Well," I said, "I will tell you what has been worrying me ever since I was little; that is, why I can see through a pane of glass."

They said, "That is the simplest thing in the world. That is because it is transparent."

We looked up the word "transparent" in the dictionary, and it means something you can see through. So, if you have two words for it you are a smart man.

I have been connected with some work down at Antioch College on photosynthesis. We are working with a material called "chlorophyll." "Chlorophyll" is Greek for "green leaf." We do not really know anything about it, but we have a Greek name for it, so it sounds as if we did.

If we could just make a quick mental change, admit our ignorance, we would recognize the truth. If we had a lot of projects, you would not have too much money in the bank, you would not have materials in the warehouses, and you would not have men sitting around doing artificial work—and I guess I am to blame for it. We are technologically behind, not technologically ahead. I want to put out my voice today to say that if industry will recognize that, then we can go ahead, and there is no limit to the things that are possible.

It is four years and a half since we had the first Diesel train running here. All we did was hand to the railroads a new tool, and they immediately used it to a degree which we could not have possibly anticipated.

The other day in New York I sat behind a great industrialist who sai to me, "The trouble with you researcl men is you never know what you want You make the thing and you start t use it and then we have to change it.'

I said, "You will always have t do that."

He said, "You will have to worl out of that."

I said, "We cannot. If we hire th old fellow he wants to make the nev thing like the old thing and then yo have to change it. If we hire th young fellow who never did it he i going to be immature on the economic and operation side of it and you wil have to change it. The only thing is you must not stop. We do not knov enough and, therefore, we have t stumble."

Whether this is a stumble or not I do not know today, but with the ex perience of over one hundred years o railroad operation, I think we will ge through without a stumble. We hav opportunities today just as great a your imagination can possibly picture and the only thing we have to do i to recognize that the state we are i is due to lack of initiative. I will tak the whole blame on our part, eve though I have not been able to sel all of our bosses on what the trou ble is.

I thank you very much.

Happy New Year

EXTREME PRESSURES

AND THEIR IMPORTANCE IN THE INVESTIGATION OF ENGINEERING PROBLEMS

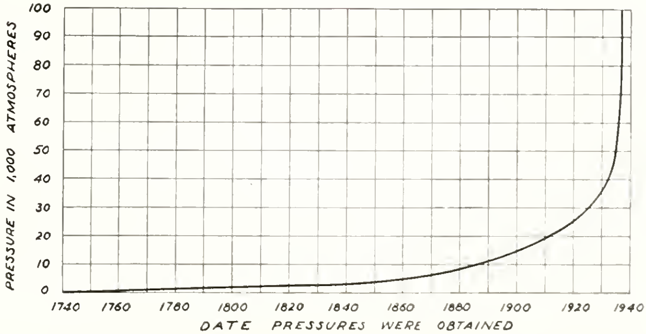
by

Thomas C. Poulter

PERHAPS the earliest high pressure work of note is the cele-rated attempt of the Florentine Acad-my to find whether water is compress-ble. Using a lead container in which hey probably had much less than a housand pounds pressure, they con-luded that water was an incom-ressible liquid. In 1762-64 Candon arried out some experiments in which e proved that water was compress-ble, and in spite of the fact that ater is frequently referred to today s an incompressible liquid, experi-ents have been carried out in which ater has been compressed to one-alf of its normal value. The fifty ear period ending 1869 was one in hich a great deal was accomplished n the field of high pressure in spite f the fact that very few good numeri-al results were obtained. Since then great deal of activity has been shown n the field of extreme pressure in-estigation, and the literature contains undreds of articles published by ore than eighty investigators so that t the present time there is a wealth f high pressure data available.

If we examine the curve which rep-esents the advance that has been ade in the maximum pressures em-loyed in this work in the past two undred years, Fig. 1, we find that is rising at such an increasing rate hat it makes even the high pressure nvestigator wonder what the future may lead to in this field. In spite of the fact that man has until recently been unable to develop pressures as high as one million pounds per square inch, such pressures are frequently occurring about us in our everyday experiences. They are, of course, confined to an extremely small space and have a very short duration. Pressures of nearly five hundred thousand pounds per square inch are occasionally produced in the Hypoid gear in the normal operation of an automobile, in roller or ball-bearings, under the wheel of a glass cutter, the bullet of a high-powered rifle striking a solid object, and in many other cases where two hard objects strike each other. Such extreme liquid or gas pressures are of course much less common, but even gas pressures of nearly a million pounds per square inch are probably occurring every day as particles of meteoric matter travelling with a velocity of thirty miles per second, collide with the very light upper layer of the earth's atmosphere.

Recently an experiment was carried out in the high pressure laboratory of the Research Foundation of Armour Institute of Technology in which a pressure of one million five hundred thousand pounds per square inch was developed. This was the highest pressure ever produced experimentally in high pressure investigations. The pressure at the center of the earth is estimated to be about three million two hundred thousand atmospheres, or only thirty two times as great as the maximum pressure that



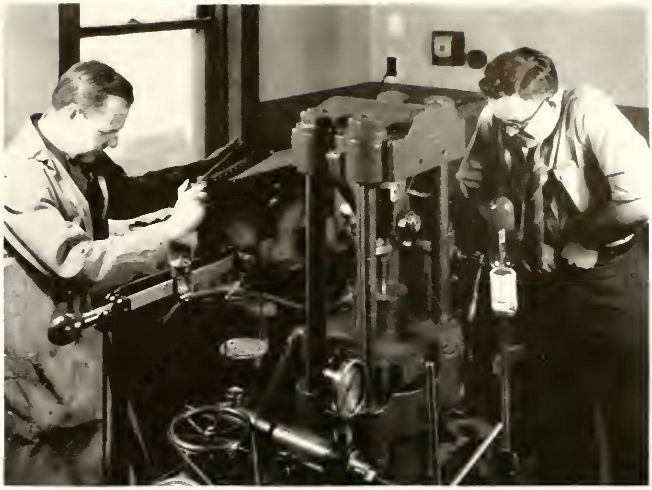
Pressure equipment used in measuring the compressibility of matter. It was with this equipment that a pressure of 1,500,000 pounds per square inch was developed.

has been produced in the laboratory. It is, of course, experimentally impossible to produce in the laboratory pressures corresponding to those at the center of the earth, but this increase in range of pressures may clear up many puzzling questions which have formerly been considered impossible of solution. Very little attempt has been made in the past to utilize extreme pressure experiments in the solution of everyday problems, but they are rapidly assuming a place of increasing importance, and in such experiments lie the answers to many questions of greatest commercial importance.

A brief survey of the work that has been carried out by means of the high pressure equipment now in the High Pressure Laboratory of the Research Foundation of Armour Institute of Technology will serve to show the greatly diversified application of such investigations. The work started in an attempt to study a reported effect of pressure upon the chemical reaction of sulphuric acid on zinc to form zinc sulphate and liberate hydrogen. This investigation was carried out to a pressure of thirty thousand atmospheres, during which it was found that the effect we had set out to study did not exist. In the course of the investigation we found many interesting things including a little known chemical reaction of hydrogen on sulphuric acid to give hydrogen sulfide and water. Other chemical reactions were investigated under extreme pressures such as the hydrolysis of sucrose. The rate of this reaction was found to decrease with increase in pressure. From the information gained as a result of our previous work, new pressure equipment was developed in which it was possible to carry on experiments in cylinders with glass, quartz, or diamond windows which will withstand pressures of one-half million pounds per square inch. In connection with this development many interesting phenomena were observed, such as the ability of glass or quartz windows one-quarter inch thick to be bent to a radius of curvature of four inches as many as ten times before being broken. The development of such windows made it possible to study the effect of pressure upon the optical rotation of optically active compounds which effect was to increase the rotation of all compounds studied, some of them being increased to three-fold their normal value. Both dextro and levo rotatory compounds were investigated. The windows also made it possible to study the phosphorescence of zinc sulfide, which effect is to decrease the intensity of the phosphorescence by a factor of one-half for a pressure of thirty thousand atmospheres. It was also found that a rapid change in pressure would produce a bright glow of the zinc sulfide. Aside from the intensity, the fluorescent and phosphorescent properties of zinc sulfide were very little affected by extremely high pressures. It, therefore, provided a convenient method of studying the effect of extreme pressures upon the radioactive decomposition of various materials by actually observing scintillation. These measurements confirmed the negative results of similar investigations by other observers using quite different methods. Further investigations made possible by the pressure windows were the determination of the effect of pressure upon the index of refraction of certain liquids. This investigation showed

Fragments of a piston that fractured under a pressure of more than one-half million pounds per square inch. Many of these pieces were imbedded in the steel guard surrounding the piston.

that the Lorenz-Lorentz relation holds for those substances investigated. The quartz windows were further utilized in making absorption spectra measurements of the effect of pressure upon the compressibility of the neodymium atoms at the various electron energy levels. The effect of pressure upon living organisms has been studied, with the observation that twelve thousand atmospheres are necessary to kill bacteria, but as the complexity of the living organism increases the pressure necessary to destroy life decreases. Hydra and planeris were found to withstand pressures of from ten to twenty thousand pounds per square inch without any serious damage. The effect of high pressures was to precipitate some of the colloidal constituents of the organism, and a study was made of the precipitation of other colloids, such as sulfur, silver, gold, ferric hydroxide, molybdenum blue, and prussian blue. Colloidal ferric hydroxide is precipitated completely by pressure as low as 100 atmospheres, whereas molybdenum blue is only slightly precipitated at a pressure of 17,000 atmospheres. The electrode potential of the hydrogen electrode was investigated up to pressures of thirty thousand atmospheres and the emf of the Weston Standard Cell up to twelve thousand atmospheres. The effect of pressure on both of these is of a rather low order of magnetism. The effect of pressure upon the penetration of water and numerous other liquids into glass and metal surfaces has been investigated with some very interesting results. Water was found to penetrate in considerably quantities to a depth of several millimeters into glass in only a few minutes time. The penetration of alcohol and ether is somewhat less, and such liquids as paraffin oils, glycerin, etc. penetrate scarcely at all. A similar effect, but to a considerable lesser degree, was observed for the penetration of liquids into metals. The penetration of gases into metals of course is more rapid than that of liquid, and represents a problem of considerable industrial importance particularly in the case of penetration of hydrogen into steel whereby the tensile strength of the steel is reduced to less than half its original value. The normal dissociation of steam into hydrogen and oxygen, and the subsequent removal of the oxygen by its reaction with the metal of the high pressure steam lines, particularly under conditions where a high superheat is used, presents a problem of utmost importance in the high pressure high superheat steam installations that are being used at the present time. It has been shown that considerable quantities of hydrogen are continually escaping through the walls of the high pressure, high superheat steam lines, and this subject should be thoroughly investigated to determine to what extent this is affecting the tensile strength of the metal of the steam lines. If this effect is cumulative, as is the case under the conditions of many of our experiments, it might very well become a problem of utmost importance in high superheat steam insulation, if not indeed a limiting factor in the industry. We have found that this effect is not only a function of the temperature and pressure, but is also affected by the composition and heat treatment of the steel. It is, therefore, a combination high pressure and metallurgical investigation, and the Research Foundation of Armour Institute of Technology is well equipped to undertake a comprehensive program in this field.



A pressure of 580,000 pounds per square inch has been developed in this cylinder containing a glass cylinder in each end. Under such pressure ordinary glass can be bent to a spherical curvature having a radius of 4 inches. This equipment opens up an entire new field of investigation covering a range of pressure phenomena varying in magnitude from studies of the earth to measuring the compressibility at various energy levels in some of the electron orbits of an individual atom.

Section of a cylinder which fractured as a result of the penetration of hydrogen into the steel.

Other fields in which we have done considerable work is in investigation of the compressibility of liquids and solids, the effect of pressure upon the viscosity of liquids, and in some cases the change of state, or even polymorphic transition.

A brief summary of the effect of pressure upon the properties of matter will reveal some very interesting facts. The following characteristics are all affected by pressure; density, volume, index of refraction, electrical conductivity, thermal conductivity, magnetic permeability, dielectric constant, optical rotation, chemical reactivity, phosphorescence, fluorescence,

physical strength, permeability to gases and liquids, and viscosity. If we consider all but the last two items on this list, we will see that the effect is anywhere from a small percent up to certainly less than a factor of ten.

But now let us consider the last two items. The permeability to gases and liquids may be of the order of magnitude of many thousand fold, and the coefficient of viscosity of many lubricating oils is increased by as much as two hundred million times their value at atmospheric pressure. It is, therefore, our belief that the permeability to gases and liquids and viscosity are the two characteristics that will present the most fruitful problems for investigation and certainly are the two that are most likely to produce noticeable effects in industrial processes involving high pressures. Investigation of the permeability of gases and liquids has already been discussed and the viscosity investigation of lubricating oils under pressure probably represents the most fruitful investigations to be carried out in this field.

Anyone familiar with tests on lubricating oils is aware of the fact that a small quantity of suspended solids in the oil is very likely to produce a bearing failure even though these particles may be softer than the two metals being lubricated. This effect is in part, if not largely, the result of the solid materials which may not be so soft at the higher pressures, so completely wiping off the lubricant as to permit the two metal surfaces to come in contact and start the failure. It is the opinion of the author that many failures under conditions where an extreme pressure lubricant is required are caused by a similar phenomena, but that it has not been generally recognized because an examination of the oil before failure shows no such foreign particles, and after the failure only such particles as have been removed from the metal surface during failure. One very likely source of such suspended particles has in general been overlooked, namely those which are liquids at normal pressures but which separate as solids under the extreme pressure. In some cases, these solids may be of metallic hardness. Water in the form of an emulsion, or even the normal small amount of moisture in the oil is converted to a solid at one-third to one-fourth the pressure frequently existing in an oil where an extreme pressure lubricant is required. The solid thus formed is known as ice VI and is very much harder than ordinary ice. Under these pressures it has a melting point about as high as the normal boiling point of water.

Some of the normal constituents of certain oils may go through a similar transition, producing a substance hard enough to wipe the lubricant from the metal surfaces, or even producing some abrasion action itself. Another phenomenon which has frequently been observed in our work at ultra pressures and which no doubt has its effect not only upon the wear, but upon subsequent failure, is the actual penetration of water or other compressed materials into the surface of the steel. The escape of such substances when the pressure is released causes a breakdown of the metal surface. If a glass rod in contact with water is subjected to such pressures and the pressure released immediately, the rod will not be affected, but if the pressure is maintained for five minutes so as to allow time for the water to penetrate the surface of the glass, and then the pressure is released, the rod will be broken up into discs; whereas, if the pressure is maintained for twenty minutes permitting the water to penetrate deeply into the glass, then released rapidly, the glass will be shattered into small pieces. Similar effects, although to a much less degree, are known for steel and other metals.

The increasing realization that pressures of as high as four hundred thousand pounds per square inch exist between two metal surfaces which are supposed to be kept separated by means of a lubricant has led to an entirely different conception of the problem. Extreme pressure lubrication is only in its infancy, and a proper method of approach to a fundamental understanding of the problem is through research at extreme pressures.

Suppose we put a lubricating oil under such a pressure, and study its physical properties. We find that it is no longer a fluid in the normal sense of the term, but that it has in some cases become quite hard. It is indeed fortunate that this is true, for if such were not case, it would be impossible to maintain a film of lubricant between many of the operating parts of a modern automobile.

The viscosity of a liquid at normal atmospheric pressure is no indication of what its viscosity or hardness may be at greatly elevated pressures. Two liquids having almost identical physical properties at one pressure may vary by several thousand fold at another pressure well within the range of those normally encountered in extreme pressure lubrication problems. The effects of pressure upon the physical properties of various liquids differ so widely as to make it possible to produce a mixture of almost any desired viscosity or hardness at almost any specified pressure.

It is the opinion of the author that the day is not far distant when the specifications of a lubricant will be largely based upon the pressure hardness curves for not only the mixture as a whole, but upon the individual constituents. This is particularly true in view of the modern conception that

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Extreme pressure equipment used in measuring the effect of pressure upon the viscosity of oils. In some cases light oil became harder than metallic lead.

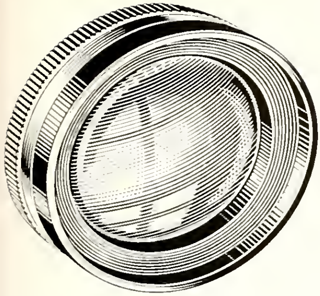


PHOTO ENGRAVING

WHAT IT IS AND HOW IT IS DONE

by
Walter B. Stearns

PHOTO-engraving is a reproductive and interpretative art. It translates an original copy of any nature, be it a photograph, a drawing, or a painting in black and white, or color, on to a metal sheet in relief so that a limitless number of facsimilies can be reproduced mechanically.

No attempt will be made in this article to go into the detailed processes and formulas involved. There are many textbooks available. It is a process based on the fundamental laws of optics and chemistry. But it is even more an art, dependent on the skill, artistic ability, and experience of the craftsmen. Each order is a separate job and a separate problem and is given individual attention all the way through. The study and application of light and color as applied to photo-engraving could occupy a student for a life time. If you are sufficiently interested to want to know more about it, I suggest a visit to a photo-engraving plant.

Zinc Etchings

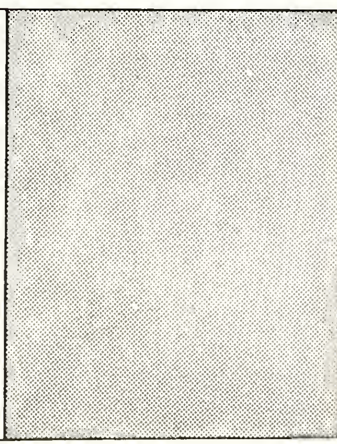
Line etchings, usually termed "zincs" are the simplest form of photo-engraving. They are made from line copies such as pen and ink drawings, tracings, dry-brushed or stippled. These copies must possess but two tones—black and white. Briefly, the process is to make a photographic negative and print this negative with high intensity arc lights on to a highly polished sensitized zinc plate. The black portions which are to be in relief are then treated with an enamel that will resist the corrosive action of the nitric acid which is used to etch away the unwanted metal. This etching is done in a machine in four or five steps, each step being termed a bite. After the routing and tooling away of imperfections and the proofing, this zinc is mounted on a wood or metal base to exact printing height, .987.

Halftones

A halftone is also a relief plate, but here we have a much more complicated and exacting task. The copy for the halftone is a photograph or a drawing in continuous tone, that is, possessing all of the tones from white to black. The negative is made by photographing through a halftone screen. A halftone screen consists of two sheets of optical glass ruled with parallel lines, cemented together with the lines at right angles, leaving square interstices through which the light rays pass. This screen is placed in the camera immediately in front of the negative, and the light in passing through forms dots on the plate, which by their size, shape, and proximity to each other, recreate the tones of the original. Each one of these dots is in fact a minute portion of the whole, and anything short of perfection in this operation means an unsatisfactory result. These screens are made in rulings of 50 lines to 150 lines to the inch. Different rulings are necessary because of the variety

Photograph of a girl, photo-engraved without the use of a halftone screen. Just two tones—black and white obtained by this means.

The halftone screen which enables the photo-engraver to reproduce accurately all tones of a copy from deepest black to absolute white.



Photograph of same girl photo-engraved with use of halftone screen faithfully reproducing the original in all tones and shades.

Above: 65 screen

Right: 100 screen

Below: 133 screen

of paper stocks that are used. A highly-coated, smooth, enamel surface, such as is used in this magazine, will accept a 133 line screen, with each dot printing sharp and true. There are 14,400 dots to each square inch in this ruling. Naturally, if one tried to print this fine detail on news print, the result would be a blur. In brief, 120, 133, and 150 line screens are used on enamel or coated papers; 100 and 110 line screens for uncoated papers; and 50, 60, and 85 for coarse pulp print paper.

This negative is printed on a sheet of highly polished sensitized copper. Copper is used instead of zinc because it is harder and more ductile, making it easier to handle in the subsequent operations, particularly re-etching and hand engraving. Etching a halftone is largely dependent on the skill, judgment, and experience of the halftone etcher. Actually, the print on metal has approximately 60% of the values of the original copy. The halftone screen while breaking the light rays, naturally flattens the whole range of tonal values. This and the difference in the reflective qualities of printers' ink as compared with original copies makes a large amount of hand work necessary if the original is to be faithfully reproduced. In practice the etcher gives the halftone a preliminary application of acid, and then with the copy in front of him he makes a careful comparison, tone for tone, with the copy. It will be found that the darker tones have probably been etched far enough, so by staging with a brush and an acid resistant ink one may block out these portions and render them impervious to further action of the acid in subsequent bites. This operation is repeated some five to ten times until the high-light portions of the copy are reached. If there are any parts of the engraving which must be pure white, they must be taken out with a hand tool by the finisher and then routed.

All of the elements affecting the final result are of such microscopic dimensions that they cannot be measured by mechanical means. The beauty of the proof is governed by the skill, experience, and judgment of the engraver. The depth in the high-light portion in a 133 line screen halftone must be .0035 and the shadow portions, .001. One-half a thousandth less than that can seriously affect the result. The entire reproduction being

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WE MEASURE OUR FRESHMEN

by

William C. Krathwohl

FORMERLY, a young man who wished to enter Armour Institute of Technology presented his high school diploma together with a check for his tuition. If these were satisfactory, he was admitted. Certain other essential qualifications were not considered, at Armour or at any other college, because they could not be measured. Some students pursued their courses uneventfully, graduated, and became successful engineers. Other students whom we now know should have done likewise, failed to fulfill expectations. There were still other students who had a tremendous struggle to get through, and others who were overwhelmed in the struggle. The latter left college and went through life with a sense of defeat, a bad thing for any human being. No one knew how to tell these young men why they had failed or what they should do. Some wild guesses were made, and by the laws of probability some of these guesses were right, but most of them were wrong.

Nowadays the situation has changed. Mathematics and new types of tests have entered the field of education. Researches in psychology are being conducted on a more scientific basis. The hidden mysteries of the human mind are being explored. Because the field is so tremendous, the solutions of the problems involved have not been completely obtained, but we are seeing the light. Although today when a freshman enters Armour he still pursues much of the old routine, in addition he must take a battery of educational tests.

Fig. 1

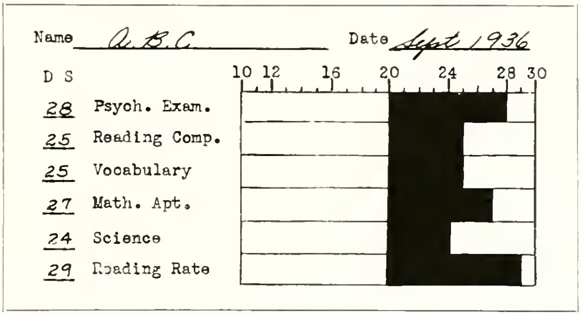
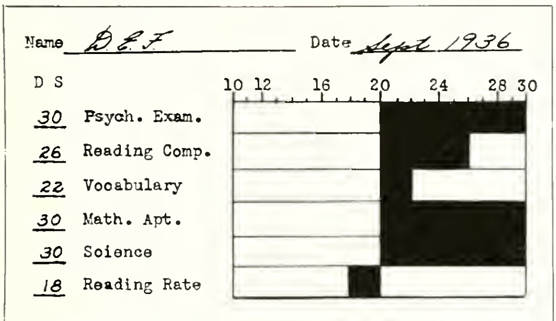


Fig. 2



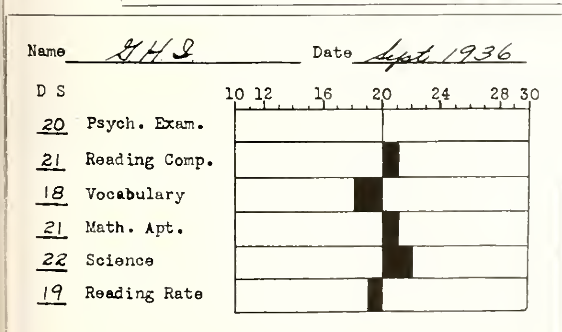


Fig. 3

It is the purpose of this article to explain the reason for these tests, to show they are employed to help a young man who should be an engineer use his talents to better advantage, and to show how frequently they throw light on the problems of those who apparently will have a great deal of trouble in the engineering field. No reason any longer exists why a student should leave Armour with a sense of defeat. Instead, he is made to realize that there is a place in this world where he can, if he wishes, be a success.

The battery of tests which during the last two years every Armour freshman has taken and which are used solely for guidance purposes are: 1. American Council on Education Psychological Examination; 2. Iowa Silent Reading Test, Advanced Form; 3. Inglis Vocabulary Test; 4. Iowa Mathematics Aptitude Test; and 5. Cooperative Test Service General Science Test.

The psychological examination is given because it tells something at the college level about the magnitude of the composite trait known as men

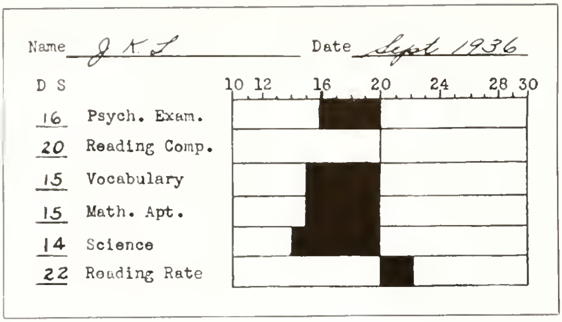
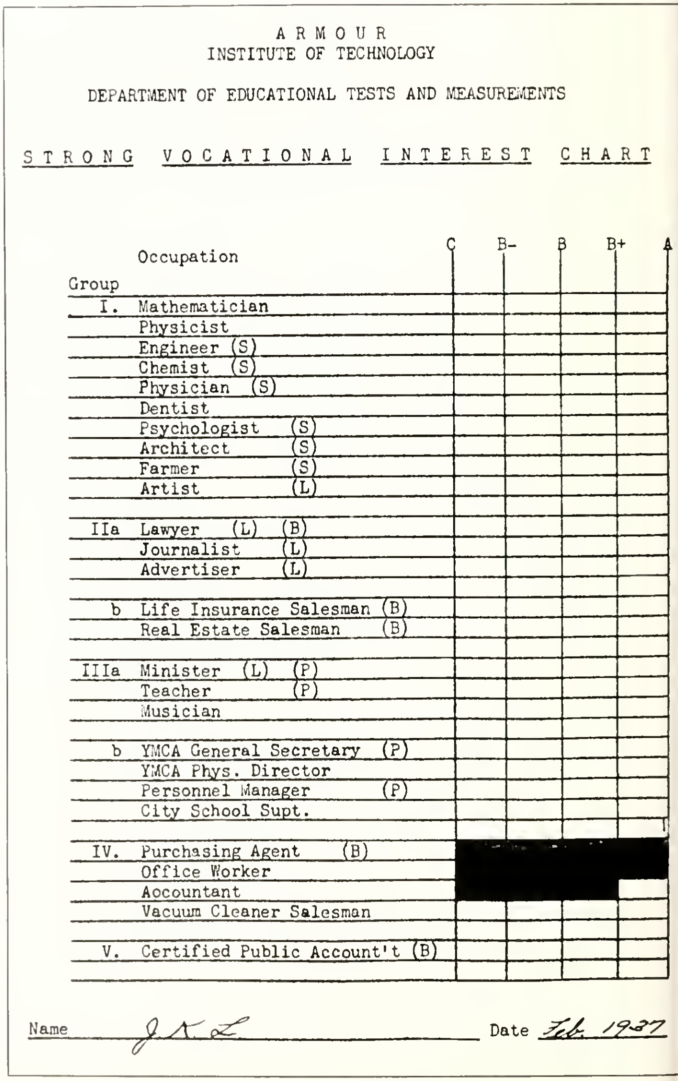


Fig. 4

Fig. 5



tal ability. It is now recognized that successful engineers are always found in the upper intelligence levels. How high this level should be depends largely on the use to which a young man wishes to put his engineering education.

Another reason for using this particular psychological examination is that it is issued in a new comparable form each year and given throughout the United States to thousands of students in hundreds of colleges. Each year a confidential report is made to every college, showing how it stands with reference to all other colleges taking the examination. The number used for comparison purposes is an average* score of the freshman class. The report issued last year placed Armour in the upper quarter of all colleges taking the examination.

The reading test is given because it gives a measure of reading comprehension. Strange as it may seem there are many people who go through the motions of reading an article and then are unable to tell what it is all about. Lack of ability to read with comprehension is almost fatal to a student. It is something that is not taught except incidentally in the schools, but which can be trained. Every modern college which has a remedial program makes this a vital part of the course.

The reading test also measures speed of reading. Some students can with comprehension read 400 words or more a minute. Others cannot read even 100 words a minute. Because the fast reader in a given interval of time can cover several times the amount of material that a slow reader can, it is easily seen why some students find it impossible to do certain kinds of home work and still have time to sleep. Fortunately a great deal is known about how to correct a slow reading rate, and this disability usually can be remedied.

The vocabulary test is given because words are the means by which civilization not only transfers ideas from one individual to another but also stores them up for future generations. This test shows whether a student can understand what his professors are talking about. Here again the range is amazing. Usually the highest score for an unselected group of freshmen is about three times the lowest score. This means that two thirds of the English words which the brightest student understands are either just meaningless sounds to the less gifted pupil or else have to be guessed by him from the context with more or less success. The explanation of some of the low scores is that they are made by students who come from homes where a foreign language is spoken. Other low scores are made by pupils

*The particular average used is the median.

who are less gifted or who have been exposed to a less favorable educational environment. One of the interesting facts that researches on vocabulary are indicating is that success in certain occupations seems always to be accompanied by an extraordinarily high vocabulary score. There is no question but that within limits vocabulary can be increased, and this the modern college takes particular pains to do.

The mathematics aptitude test attempts to find out if a student has mathematical ability. This ability is so essential in some branches of engineering that it is foolish for a student to proceed in them if it is known in advance that he cannot succeed. Mathematics aptitude seems to be a characteristic part of an individual like height and weight all of which can be modified only within strict limits. However, if a student possesses this aptitude, the instructor at least has a chance to teach him some mathematics. The difficulty of separating mathematics aptitude from mathematics training still exists. Every test devised so far involves some training. Hence, scores on this test must be interpreted with considerable skill and caution.

The science test is in Armour's experimental group. It was chosen to ascertain the type of reading in which a student indulges. If he is intensely interested in engineering and if a love of science permeates every fiber of his being, a prospective engineer will read every bit of science on which he can lay his hands. The man who is not a born engineer is more apt to regale himself with the light literature which adorns our news stands. This test covers such a wide range of subjects that it is easy for one who is at all scientifically inclined to make a fair score. The scores made by Armour students on this test are usually so high that one is led to believe that an interest in science is the motivating factor which makes many students select engineering as a profession.

After the tests are corrected the scores are transformed by well-known statistical methods into others which are called Derived Scores. These have the two properties that a meaningful comparison can be made between the scores of different pupils on the same test and a meaningful comparison can be made between the scores made on different tests by the same pupil. The zero point is taken at the average of the class in that test and given a value of 20. The unit of measure is the standard deviation of the distribution and is given a value of 4.

Derived scores also have the advantage that the mental equipment of an individual can readily be shown by means of a bar graph as is illustrated in the accompanying figures. The bars indicate the amount of divergence of the performance of a student from the average. If his performance is the same on every test, the ends of the bars will lie on a straight line. The indentations and projections of his profile if they are unusual will indicate marked weaknesses or strengths. If his performance on every test is just equal to the average of the class, his educational profile will consist of the vertical straight line through the number 20.

Figure 1 is the educational profile of a superior student. This young man has consistently made a grade of A in his courses, with only an occasional B.

Figure 2 shows the educational profile of a superior student whose reading and vocabulary scores were neither consistent with the other scores nor with his achievement in class. Two possibilities are suggested. Either he did not do himself justice on the tests, or the cause must lie outside the tests

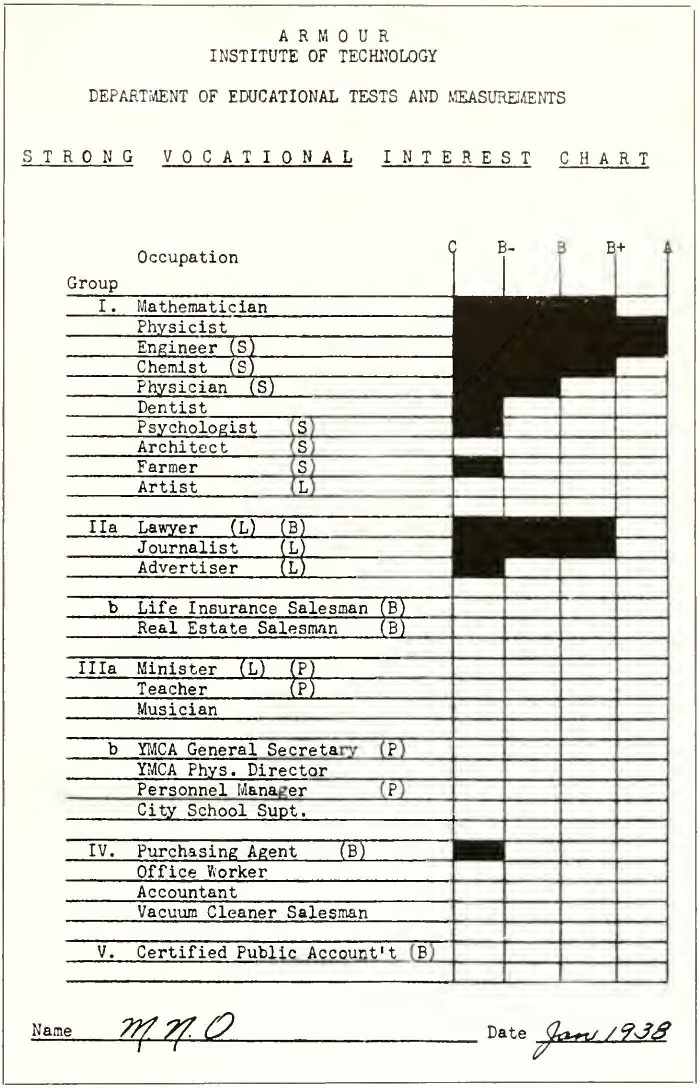


Fig. 6

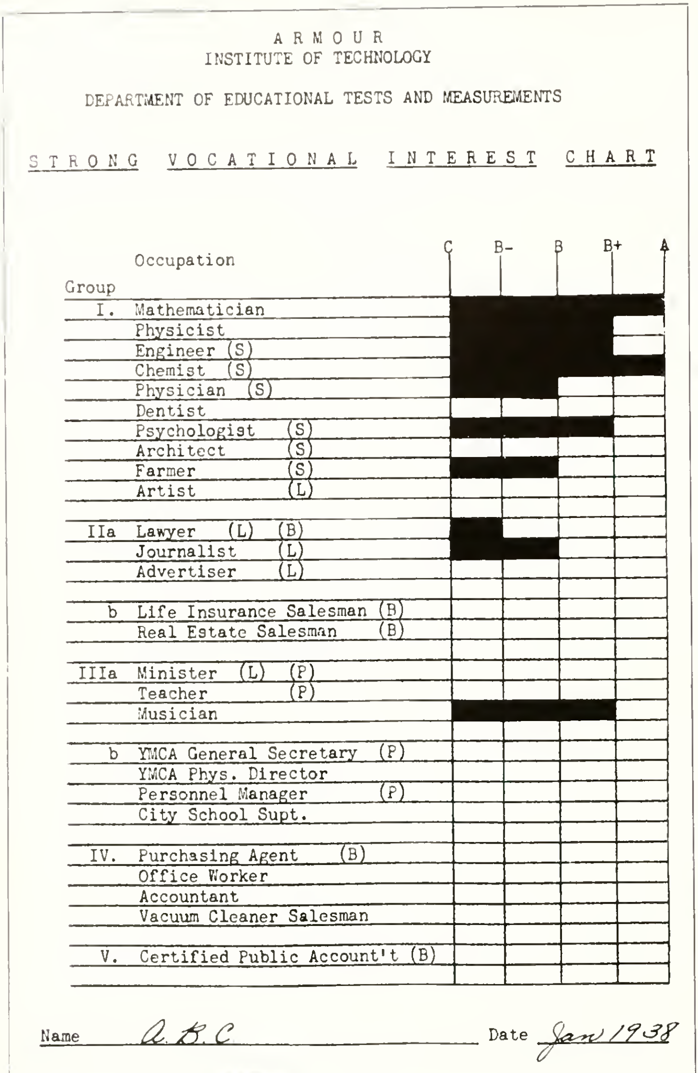


Fig. 7

themselves. Fortunately the difficulty was found to be an easily corrected visual defect of which the student had never been aware.

Figure 3 is that of an average student. He was very much interested in the tests and asked to see his score. Since these scores are kept confidential, a student is permitted to see only his own score, and then it is carefully explained to him by a member of the advisory staff. He was told that his educational profile indicated only average grades, but if he put forth an unusual effort he could improve them. This the young man proceeded to do, with the result that 70% of his freshman grades were B's and A's.

Figure 4 is the educational profile of a student who as a freshman had great difficulty in all of his courses. He was not sure that he wished to be an engineer, although his parents wanted him to be one. He was given the Strong Vocational Interest test, and the results are shown in Figure 5. This confirmed his opinion that he should be in some other field of work, probably of a clerical nature.

It must not be assumed from these illustrations that conclusions can always be drawn so easily. In every class there exists a group of students who have average or poor educational profiles and who by sheer persistance and perseverence consistently make the greatest use of their talents and get honor grades. On the other hand, there is also a group of superior students, splendidly equipped mentally, who consistently fail. This group constitutes one of the greatest and most acute problems in the field of education today. These students have everything that a superior student should have. They surprise their instructors at times with their readiness to grasp new ideas. There does not seem to be any reason why they should fail, and still they do. One reason for their failure is sometimes found in the fact that they needed so little effort in high school to compete with others of lesser ability that they acquired poor habits of work. When competition in college became keener, they found that they were unable to adjust themselves to the new environment.

Sometimes students fail to make good for quite different reasons. Some of these are financial. A young man cannot do himself justice if he has to wonder every day where he will get his next meal. Other reasons are concerned with home life and surroundings. A broken home frequently reacts with disastrous results. Such students should not be condemned. No two human beings are made alike. While one person may rise above his troubles, another person equally brilliant and equally useful to society might without help become overwhelmed.

Part of the function of the advisory staff at Armour is to reclaim some of this precious material and to get these young men to do the kind of work they are capable of doing. Before tests were introduced at Armour, only a guess could be made as to why certain students were failing. Now it is possible to eliminate some of the guess work. In the future it may well be that a much wiser world with different attitudes and different mechanisms will largely eliminate the waste of human material which exists at the present time.

The question naturally arises, what is done at Armour to remedy these disabilities which can be cured? Each semester those students who can profit by remedial training are invited to take a "Study Habits" course. They rarely refuse. More frequently students who do not need these courses as badly as others will volunteer in order to make better use of their abilities. In this course they are taught to read with comprehension, to speed up their reading rate, to enlarge their vo-

cabulary, and to correct poor study habits. Other courses available to upper classmen show how the principles of psychology can be applied to the business world, how it is possible to get along with people, and how one can remove many personality handicaps.

This year the testing program has been enlarged to include the testing of the vision and hearing of every freshman. Physical handicaps, which often can easily be corrected, are sometimes the real cause of a student's failures and result in poor study habits. Students have been found who from birth had visual defects of which they had not been aware. They had been born with these defects and had never known anything different. Where such defects exist the student is told of them and advised to consult an ophthalmologist. When a student has difficulty in hearing, he is advised always to sit as close to his instructor as possible. Many students have never been aware that their hearing was not as good as that of their fellows.

Frequently, the educational tests have to be supplemented in individual cases by other types of tests. One of the most useful of these is the Strong Vocational Interest test which was described in the article "Are You Happy With Your Work" in the December, 1937 issue of this magazine. Occasionally there exists a student who although he is successful in his engineering studies, still questions whether he should be an engineer. If the test indicates that he has the characteristic interest profile of an engineer, he is stimulated to pursue his course with renewed vigor. If the test indicates that he does not, he frequently can find another use for his engineering education. A specific instance is that of the manager of a publishing company who claims that his success in a field so remote from engineering is entirely due to the methods of approaching, attacking and solving problems which he learned as an engineering student. On the other hand, the student who does not possess the educational qualifications for an engineer and who does not possess the characteristic vocational interests can be shown other fields in which he has an opportunity to make a success.

The bar graphs illustrated in figures 5, 6, and 7 show the vast differences that exist in characteristic vocational interests.

Figure 5 is the characteristic vocational interest chart of the young man whose educational profile was given in Figure 4. When comparing figures 4 and 5 one should keep in mind that educational abilities and characteristic vocational interests are entirely independent of each other. Even superior students sometimes show a characteristic vocational interest profile similar to Figure 5.

Figure 6 is the characteristic vocational interest chart of the student whose educational profile was given in Figure 1. It will be interesting to follow the career of this young man for the next twenty years.

Figure 7 is the characteristic vocational interest profile of a nationally known research chemist.

The college student of today has a great deal to be thankful for. He is profiting from the labors of myriads of workers in the educational field. Psychologists are helping him to know himself. Educators are as much concerned about his adjustment to society as they are about his accumulation of knowledge. Mathematicians are furnishing the means by which these investigations can be carried out scientifically. As a result, much more is known concerning the minds of our young men and young women than ever before. A student no longer needs to go through life smarting with a defeat incurred during his college years. He can find out much better than his father ever could about the measure of his intellectual stature and about the niche in life he was intended to fill. He can be happy with his work.

VOCATIONAL INTEREST TEST FOR MEN AND WOMEN

THE response to the article "Are You Happy With Your Work" which appeared in the December number of the Armour Engineer and Alumnus was as gratifying as it was unexpected. Requests to take the test at home are still being received. Another unexpected feature was the number of requests received from women.

Unfortunately the difference in sexes is such that the Strong Vocational Interest Test for Men ceases to be valid for women. Strong corrected this deficiency by preparing and validating a special test for them. This test distinguishes characteristic interests for the following occupations for women: author, librarian, artist, physician, dentist, life insurance saleswoman, social worker, teacher of English, teacher in general, teacher of social sciences, teacher of mathematics and physical sciences, lawyer, Y. W. C. A. secretary, nurse, stenography, secretary, general office worker, and housewife.

The Department of Educational Tests and Measurements at the Institute is now prepared to give this test which, if directions are carefully followed, can be taken at home.

It has been found that some occupations for women can be distinguished by certain likes and dislikes characteristic of those occupations. For instance, there are certain groups of likes, dislikes, and interests of a nurse which are entirely different from those of women in general. This does not mean that the person likes nursing any more than that the possession of certain interests common only to engineers means that the man who has those interests likes engineering. It means, rather, that in the first case the woman looks like a nurse if viewed from the standpoint of interests, just as the man looks like an engineer if all that one could see were his likes and dislikes. The absence of these characteristic interests for an occupation usually means failure. Their possession, if accompanied by the proper aptitudes and personality, means satisfaction and contentment, and this usually means success.

The Department of Educational Tests and Measurements is now prepared to give this test, which can be taken at home if directions are carefully followed. All that is necessary is to send a request for either the man's or the woman's Strong Vocational Interest Test, accompanied by a remittance of one dollar the actual cost of the service, to Dr. W. C. Krathwohl, Director, Department of Educational Tests and Measurements, Armour Institute of Technology, 3300 Federal Street, Chicago, Illinois.

"AN ANNUAL GIFT FROM EVERY ALUMNUS" COMMITTEE ANNOUNCED

The financial program of the Alumni Association to help defray the expense of remodeling the Armour Mission and installing new and modern equipment and furnishings for the Student Union was launched rather auspiciously Friday evening, December 2nd, Thirty-nine members of the Committee actively engaged in the promotion of AN ANNUAL GIFT FROM EVERY ALUMNUS attended a dinner on that evening at the Chicago Engineers Club. After the dinner they listened to talks by President H. T. Heald and Professor D. P. Moreton.

President Heald outlined the more important developments that have taken place at the Institute in recent months. He lauded the usefulness and purpose of the Institute and paid fitting tribute to the Alumni who have so materially aided its development.

Professor Moreton told about the changes that had been made in remodeling the Armour Mission Building He explained its added facilities and enumerated some of the equipment and furnishings that have been installed

J. Warren McCaffrey, Chairman, speaking for the Executive Committee, then outlined briefly the manner in which the work of contacting and soliciting all Alumni and former students of Armour Institute should be carried on. He stressed the point that the present program was not a campaign to raise money by any of the well known high pressure methods, such as, repeatedly calling on prospects to the point of annoyance, overselling, and coercion. On the contrary, the plan of the Committee is to make a thorough and earnest effort to contact and interview, in every case possible, 3800 Alumni and former students for the purpose of explaining our plans for the Institute and inviting them to participate in the program.

The approximate total cost of the transformation of the Armour Mission of yesteryear to the Student Union of today is fifty thousand dollars. It is the object of the Committee to obtain sufficient contributions during this school year from which to pay ten thousand dollars towards the cost of the improvement. It is believed that such an amount can be raised if enough of the Alumni are solicited. Acordingly the immediate job confronting the Committee in charge of the financial program for this year is to contact every Alumnus and former student of Armour Institute. The Executive Committee have indicated that they assumed their responsibility, understanding fully the scope of the work before them and that they will continue the work until every Alumnus and former student has been interviewed or at least contacted and acquainted with the aims and object of the program.

The Chairman also announced the entire membership of the Committee which has undertaken the work of promoting the financial program for the school year 1938-39. The complete personnel of the Committee is as follows:

J. Warren McCaffrey '22
Chairman

Fred B. Attwood '31
Secretary

William F. Sims '97
Vice-Chairman
Ralph H. Rice '97
John M Humiston '98
Carl P. Schroeder '99
Max Sklovsky '00
John B Swift '01
Roy M Henderson '02
Arthur Wagner '03
Vice-Chairman
Arthur Wagner '03
Clarence T McDonald '04
Frank A Putt '05
Franklin A Wanner '06
Frederick G Heuchling '07
Charles S. Packer '08
Raphael N. Friedman '11
Vice-Chairman
Arthur P. Strong '09
Herbert W. Martin '10
John B. Johnson '11
Edwin M. Sincere '12
Roger E. Burley '13
Louis Hirsh '14
Claude A Knuepfer '15
Vice-Chairman
William B. Bready '15
Victor E Marx '16
Clinton F Stryker '17
Vice-Chairman
A S. Benjamin '17
Axel A. Hofgren '18
Robert S Melichar '19
Walter M Seyferlich '20
Richard J. Grant '21
Ralph S. Kenrick '22
Edward J. Schaack, Jr '23
Chester S. Shaffer '24
Eugene Voita '25
Stanley Owens '26
Harold W. Munday '23
Vice-Chairman
George L. Parkhurst '27
*Kent H. Parker '28
Raymond F. Stellar '29
Edward R. Rowley '30
Daniel J. Iverson '31
Harvey C. Rossing '32
Arthur H. Jens '31
Vice-Chairman
Wilfred W. Davies '33
Harold W. A Davidson '3
William B. Ahern '35
Earl J. Kirsch '36
Arthur Goldsmith '37
Calvin K. Nauman '38
John J. Schommer '12
Vice-Chairma

In charge of contactin and soliciting all Alumni and former studen located outside of Ch cago.

*Because of sudden illness Kent H. Parker is unabl to represent the class of 1928. His successor has nc been appointed.

SOIL TESTS FOR CHICAGO SUBWAY

CONDUCTED AT ARMOUR INSTITUTE OF TECHNOLOGY

Professor Herbert Ensz conducting a test in the soil mechanics laboratory.

PROFESSOR HERBERT ENSZ, associate professor of Civil Engineering, and the new soil testing laboratory have been closely associated with an important part of the preliminary work necessary in the construction of Chicago's new subway. Acting as general investigator and approver of designs, Professor Ensz has been conducting tests on the soil samples taken from various points on the selected subway site in order to determine the nature and characteristics of the soil.

The soil tests, which are still being conducted, consist largely of determinations of the settlement and structural stability of the soil in question. In the analysis for settlement and stability the clay samples were investigated for water content, plastic limits, and ultimate settlement. These and other tests were started several months ago and have revealed all of the physical properties of the soil. The results of the investigations show that the location chosen for the subway is suitable for the proposed structure.

The soil research laboratory, where the tests are being made, has been a part of Armour for the past two years. It is principally concerned with highly advanced soil mechanics and several graduate students and student assistants are working there constantly.

PHOTO-ENGRAVING

(From page 36)

ased on dots, each dot must leave an xact sharp and clear impression on he paper. A minute variation in the hickness of the film of ink or one en-thousandth of difference in the impression can make a muddy result. Every halftone is worked on by eight lifferent men, each a specialist with ears of experience. Not less than eventeen different chemicals and ingredients are used.

Color Process

By means of color process plates, ll the colors of the spectrum are at he command of the engraver. This s possible because white light is composed of exactly equal portions of ellow, red, and blue. Actually we on't see red, but see only the red porion of the reflected light as the obect at which we are looking absorbs he yellow and blue from the white ight. By use of this knowledge of ubtractive color, we are able to make hree separation negatives from the olor copy, one reproducing all of the ellow, one the red, and one the blue. 'o do this we must use a filter with olors complimentary to the one we re separating. That is, to make a ellow separation, we must use a violet filter. The violet filter, having both red and blue, absorbs these colors, allowing only the yellow to pass through to the sensitized plate. An orange filter is used for the blue separation and a green filter for the red separation.

These negatives are printed on metal with the lines of the screen angled sufficiently far apart so that the dots instead of printing on top of each other print alongside of each other. In the finished proof, the yellow dot and the blue dot, for instance, because of the fineness of the screen, will merge as far as the eye can see and give the impression of green. In this work the etcher has a much more difficult task as he must not only etch into the plates the original tones of the copy but so proportion and balance them that the original hue as well as tone is faithfully reproduced.

After the etching, impressions are taken from these plates in order—yellow, red, blue, and black—placed in exact register so that in comparison with the copy the printed result is practically a facsimile. This is letter-press printing, the very nature of which is such that it excels all other printing methods in clearness, sharpness, and fidelity to the original.

EXTREME PRESSURES

(From page 34)

a lubricant is a fluid without harmful properties serving as a carrier for a very small quantity of material which produces a lubricating action. The proper hardness curves can be theoretically determined from the condition under which the oil is intended to operate, taking into account the hardness and curvature of the two surfaces, the rate of motion of the contact point with respect to these two surfaces, the rate of motion of one surface with respect to the other, and other conditions affecting the plastic flow of the lubricant. With these specifications available, it will be possible for the lubrication engineer to design a lubricant that will have the physical characteristics necessary for it to serve as a lubricant in the true sense of the word, and which will prevent abrasion of the two metal surfaces.

It was the development of a new steel that permitted the production of an automobile requiring an E P lubricant. One has but to consider the present trends in the development of alloy steels to realize that the time is already at hand when an E P lubricant of a still higher order of magnitude is required.

"JOURNEY'S END"

TO BE PRESENTED BY

ARMOUR PLAYERS

Scene from "Journey's End"

On Friday night, January 6, at 8 o'clock, the Armour Players will present their first play of the year at the Institute in the new Student Union building. *Journey's End*, by R. C. Sherriff, presents the soldier of the World War, as only a man who had been in the front line trenches could present him. There is none of the sentimentality of an emotional war, and none of the brutality of an over-realistic war. There is, however, a stark honesty, there is tragedy, and there is the experience which only a great play can produce.

The setting of the play is a dugout some fifty yards behind the front lines. Five officers representing five types of human beings are brought together by the situation of war. Each reacts in his own manner to the strain under which he is brought, and each is held to his duty by something outside himself, even though he realizes only too well the futility of it all. There is no propaganda of any sort undertaken by the play, and there is no moral preached. But the play, *Journey's End*, will outlive most of the plays so far produced in the twentieth century.

The cast has done a workmanlike job of their rehearsals. Each member of the Players has accepted his task and is doing it enthusiastically. A cast of eleven will present the play; but a group of twenty is working equally hard upon the technical problems presented by the production. The play is unusual in that it demands a ceiling to the set on which the play is given. The reason for this will be apparent to those who attend.

There is no hero; that is, there is no actor who takes the center of the stage for all the strong lines. Who the hero is, the audience must decide for itself. In this respect the play is indeed modern, for the day of the bouquet to the star is past. Consequently, there is greater opportunity for excellent acting in the minor roles.

The play is being directed by Professor M. G. Christophersen of the Department of Language and Literature.

The cast includes:

Capt. Stanhope—Bernard Sternfeld.
Capt. Hardy—Robert Jaffee.
Lt. Osborne—Charles McAleer.
Lt. Trotter—Leon Epstein.
Lt. Hibbert—James Duncan.
Lt. Raleigh—Ray Nerhus.
Mason—Tom Hunter.
Sgt. Major—Sidney Silverman.
Colonel—Arthur Hansen.
Soldier—Charles Schultz.
German boy—Frank Hanneman.

The technical staff consists of the following:

Production Mgr.—Ralph Erisman
Business Mgr.—Oliver Doe.
Stage Mgr.—William Buckman.
Properties—Roy Brinkman, Robert Underhill.
Publicity—Eugene Kalnin.

Following the play the auditorium will be cleared and dancing will continue until midnight.

FATHER AND SONS BANQUET

JANUARY 11

The annual Fathers' and Sons' Banquet is scheduled, this year, for Wednesday, January 11, at 6:30 P. M. in the new dining room of the Student Union.

In previous years it was not feasible to hold the banquet at the Institute, but the rehabilitated Mission offers many advantages, among them the opportunity afforded fathers of seeing the school and the improvements of the past year.

Sponsored by the Armour Tech Student Association, the annual banquets bring the students, their fathers and members of the faculty into a more familiar and a more closely-knit group. They help to maintain the interest of the parents, giving the fathers a better insight into the functions of the Institute.

ANNUAL CONCERT ARMOUR MUSICAL ORGANIZATIONS

FEBRUARY 23

O. Gordon Erickson
Musical Director, at
Armour Institute of Technology

EXTENSIVE preparations are now under way to make this year's Goodman Theater concert on Thursday night, February 23, the best one ever to be presented. There will be new songs, new orchestral selections, novelties, new stage backgrounds, and new lighting effects. Mr. O. Gordon Erickson is training the 120 men of the glee club and orchestra to sing and play such numbers as "Hymn to the Night," by Campbell-Tipton, selections from "Lohengrin" by Wagner, and the "Rangers' Song" by Tierney.

The solos will feature Donald Charlton's sonorous trombone, George Danforth's magic keyboard, Harold Doolittle's blazing trumpet, William Mashinter's singing violin, and Thomas Yeakle's basso profundo. In the novelty act there are Ted Gromak and Herbert Hansen with their banjo-mandolin and accordion duets.

So far this semester the Musical Clubs have presented two concerts: a noon performance in the main rotunda of the Art Institute of Chicago, and the annual Christmas Concert held at the Institute, December 16. The latter program was the first appearance of the Clubs on campus this term.

The remainder of the season will be an extremely active one; appearances will be made at the larger Chicago radio broadcasting studios and the more exclusive city and suburban clubs.

Plan to be at the Goodman Theater Thursday night, February 23, 1939.

ANNUAL HOME COMING OF ARMOUR ALUMNI

NEARLY three hundred guests, consisting of alumni, representing practically every class of the Institute, trustees, and members of the faculty, were present at the first of Armour's annual homecoming dinners held in the new Union dining room, Friday, Dec. 9.

Dr. George F. Scherger, the principal speaker of the evening, refreshed the graduates' memories with reminiscences of Armour's past, recalling the days of Gunsaulus, Monin, P. D. Armour, and other important figures in the history of the Institute. The story of the origin of Armour Mission was reviewed as Dr. Scherger's speech turned to the fateful sermon on the training of young men with which Dr. Gunsaulus so impressed Mr. Armour that he supplied a million dollars for the founding of a school embodying the principles expressed by Dr. Gunsaulus.

President H. T. Heald turned thoughts from the past to the present with consideration of Armour's advancement and plans for the future. He told of the diverse fields of activity engaged in by the school and mentioned the great advancement of the evening school and graduate division. In discussing the enlargement of the placement facilities, the president urged alumni to get in touch with Professor Schommer if they either know of an opportunity for employment or need a job themselves.

Mr. Harold A. Vagtborg, managing director of the Research Foundation, talked briefly of the Foundation's activities and announced that the laboratories were open for inspection by the alumni. After the meeting, many of the alumni took the opportunity to obtain at first hand a view of the new department.

Bernard Weissman

Mr. Bernard Weissman, coach of boxing and wrestling, was recently elected manager of the new Student Union.

The plan for the operation of the Union calls for a staff consisting of the manager, two student managers, and five assistants. This group will work on the organization of the rules governing the operation of the Student Union. They will be directly accountable to the Armour Tech Student Association.

ALUMNI NOTES

By D. P. Moreton

1899

WILLIAM B. PAVEY, B.S. M.E., passed away May 18, 1938, after a short illness. We extend our heart felt sympathies.

1903

HANS JORGEN HANSEN, B.S. C.E., former office engineer for the Chicago, Milwaukee, St. Paul and Pacific R. R. Company, passed away Nov. 4, 1938. His friends and associates held him in high regard.

1904

HARRY C. ABELL, B.S. E.E., 69 years old, who until his retirement a few years ago has been an officer in several large public utilities and holding companies, died November 24, 1938, at New Orleans, La. He had served as vice president of the Electric Power and Light Corporation and also as director of the United States Chamber of Commerce.

1909

GEORGE A. GRASSBY, JR., B.S. M.E., is head of the department of Physics at Ironwood Junior College, Ironwood, Mich.

1913

WARREN F. FRYBURG, B.S. E.E., residing at 2216 Kerrwood Road, Cleveland Heights, Ohio, called at the alumni office while passing through Chicago on a recent trip through the central part of the United States. He is with Black and Decker Electric Co., Kent, Ohio.

1916

CHESTER F. WRIGHT, B.S. E.E., residing at 6th Avenue Extension, Lake Worth, Fla., was in the alumni office the latter part of October and inspected the improvements being made to the Mission at that time. Wright is a registered engineer and surveyor, city engineer, and vice president of the State Board of Engineering Examiners. His business address is P. O. Box 467, Lake Worth, Fla.

1926

ALFRED JOSEPH DANZIGER, B.S. F.P.E., 2623-39 St., Des Moines, Iowa, is special agent for Crum & Forster in Iowa and will be transferred to Ohio some time in January. He worked five years with the Iowa Inspection Bureau in both the schedule and sprinklered risk departments. His headquarters will be in Columbus and he will work with State Agent L. C. Dame in the Citizens Bank Bldg.

1928

LEO B. MILLER, B.S. F.P.E., is listed among the missing although we have indirectly received information that he has been appointed Michigan state agent for the Meserole Insurance Group, LaFayette Bldg., Detroit, Mich. A letter addressed to him there has not been answered.

JOHN THEODORE EVEN, B.S. F.P.E., 140 N. State St., Aurora, Ill., has joined the Fireman's Fund Ins. group as staff engineer in the Western Dept., 175 W. Jackson Blvd., Room A-835, Chicago. He spent five years in the sprinklered risk depart-

ment of the Chicago Board after graduating from Armour Institute. During that time Mr. Even studied law and has been admitted to practice in Illinois. He later completed a year of graduate work at Chicago Kent College of Law, specializing in insurance law. Mr. Even will augment the engineering staff serving agents in the fifteen states comprising the Western Dept.

1931

ARTHUR HENRY JENS, B.S. F.P.E., 1024 Noyes Ave., Evanston, Ill., is engineer for Springfield Fire and Marine Ins. Co., 222 W. Adams St., Chicago. Congratulations are in order as Mr. Jens was married to the former Miss Evelyn Marie Heckendorf of Madison, Wis., the early part of October.

EDWARD C. ERLAND, B. S. in F.P.E., recently informed us that he is residing at Buckingham Hotel, 1500 LaSalle Ave., Minneapolis, Minn., and that he is a Minnesota state agent for the Fireman's Insurance Co. of Newark, N. J., with business address as 914 Hodgson Bldg., Minneapolis.

1932

HARRY PAUL RICHTER, B.S. C.E., 1401 West 71st Place, Chicago, was married to Miss LaVerne Mae Moss on the 27th of August, this year. Congratulations! Mr. Richter is real estate engineer for Carnegie-Illinois Steel Corp., 208 South La Salle St., Room 1038, Chicago, and is also instructor at the Schurz evening high school.

JOHN J. ARENDS, B.S. F.P.E., was recently appointed special agent for Globe & Rutgers Ins. Co., 114 W. South St., Kalamazoo, Mich. He lives at 732 Douglas Ave., same city.

1934

DONALD N. CHADWICK, B.S. E.E., moved from Kansas City, Mo., to 2300 West 109 St., Chicago, in October. He expects to go in business with his father, conducting a magazine subscription sales office at the address given.

Mr. and Mrs. ROBERT F. SIMPSON, (B.S. C.E.) have a new baby boy, Roger Allen, born Sept. 10, 1938. Hearty congratulations and best wishes. Mr. Simpson is superintendent of the Chief Wash Co., 5425 N. Moyne St., Chicago, and resides at 929 Summerdale Ave.

R. W. SWANSON, B.S. F.P.E., was appointed state agent for North Dakota for the America Fore Ins. Companies, 710 Black Bldg., Fargo, N. D. Mr. Swanson has been with these companies since the summer of 1937, and before that was for three years with the Iowa Insurance Service Bureau. Residence, 327 Ninth Ave., So., Fargo, N. D.

1935

KARL M. HANSON, Ex. E.E., radio operator for Station WLMJ, Milwaukee, Wis., recently inquired about his classmates, ORLAND R. MURPHY, E.E. '31, and WILLIAM A. SCHRADER, E.E. '31.

THOMAS F. JONES, B.S. M.E., 2735 N. 77th Ave., Elmwood Park, Ill., is engineer for Cline Electric and Mfg. Co., 211 W. Wacker Drive, Chicago. He reports his marriage to Miss Johanna R. Janz of Chicago about two years ago; no additions to the family as yet, however.

We have recently received news from ARMAND J. HAHN, B.S. Chem. E., '35, of his marriage on September 7, 1938, to Miss Sylvia Bobzien at the St. Paul's Church in Chicago. They are now living in Urbana, Ill., where Mr. Hahn is working on his Doctor's degree and instructing a class in Dairy Manufacturing at the University of Illinois. His new address is 705 Nevada, Urbana, Ill.

1937

WILLIAM A. CHAPIN, JR., B.S. E.E., visited the alumni office during his vacation in Chicago. His permanent Chicago address is 3140 Diversey Ave. He is, however, now employed as student engineer by General Electric Co., 1 River Road, Schenectady, N. Y.

JOHN H. DAMIANI, B.S. M.E., physics instructor at Chicago Tilden technical high school, resides at 1832 N. Orleans St., Chicago. He dropped in at the alumni office and gave same valuable information regarding other alumni at Tilden High.

ROBERT K. FREEMAN, B.S. F.P.E., is connected with Michigan Inspection Bureau, 400 Barlum Tower, Detroit, Mich. Residence, 22 Wellesley Drive, Pleasant Ridge, Mich. During his vacation in Chicago in September he called at the alumni office.

EDWARD F. HICKEY, B.S. E.E., with Fairbanks Morse and Co., has been transferred from their Detroit branch to Chicago, 606 South Michigan Ave., Sales Engineering Dept. His home address is 507 So. Lockwood Ave., Chicago, Ill.

FRANKLIN DAVID HOFFERT, B.S. Ch.E., 1015 Grove St., Downers Grove, Ill., is junior chemical engineer for Universal Oil Products Co.,

310 S. Michigan Ave., Chicago, was in the office the other day.

PAUL MILLER MARTIN, B.S. E.E., while visiting his folks at 4832 Bernard St., Chicago, visited the alumni office to inform us that he is still with Westinghouse Electric Elevating Co., Jersey City, N. J. His residence in that city is 654 Bergen Ave.

LETTERS FROM FAR AND NEAR

The following information is taken from a letter recently received by the Alumni office:

Five Armour alumni received awards in a recent contest sponsored by the Lincoln Arc Welding Foundation. Then five men, Messrs. Harry Eichen, Harold Verson, Charles A. Schneider, T. G. Cleaver, and Raymond O. Krengel, were chosen, in the respective divisions of the contest with which each was concerned, by a jury of thirty-one engineering authorities, from leading universities and colleges throughout the country, a tribute to their ability.

Harry P. Eichen graduated from the mechanical engineering department in 1928 and has since been employed by the Cisking Corporation, for which company he is now a design engineer.

Harold Verson, chief engineer of the Verson All Steel Press Company, hsa been with the firm for fourteen years.

Charles A. Schneider, a member of the Engineering Corps of the U. S. Army during the World War, has been associated with the Link Belt Company in Chicago for twenty-two years.

T. G. Cleaver, now residing in Pittsburgh, where he is employed by the Carnegie Illinois Steel Corporation as a sales engineer, graduated from the civil engineering department in 1911.

Raymond O. Krengel has been employed for the past twelve years by Revere Copper and Brass, Inc., now occupying the position of machine designer and assistant to the chief engineer.

The following letter from Eugene Chin, B.S. Arch. '31, was sent to us

by Eugene Voita. Mr. Voita urges that we publish it for the benefit of Chin's old friends, who may wish to write a line to him. He says, "*I know it will be appreciated with that fine unparalleled Chinese gratitude that is Eugene Chin's. This moral help to our good friend is very timely and worth while and will help lessen the horrors of life in war torn China today.*"

Dear Gene:

A great many things have happened on this side of the water, and are still happening since I last wrote you in January. With the whole country war-torn, like a prairie on fire, it is a difficult task to gather one's senses on a sane plane and put oneself in such a composed frame of mind to make a letter intelligible. How is it possible after witnessing such ghastly scenes as blown heads and limbs and bodies by the hundreds scattered about on streets so familiar to one's every day life! Can you quite connect those narrow streets with quaint shops and filled with humanity to withstand 500 pound bombs—however you stretch your imagination. And yet this is the Canton you once knew of and those are the streets once tread and the very shops we once poked our heads into. To have to sit tight for a whole week in those air raids is an experience never to be forgotten; high-powered machine guns barking to beat hell. anti-aircraft gun shells bursting, seemingly as though it's only a few feet above one's head, and that nerve-wracking z-z-z-z-z-zoom of heavy bombs clashing down to shake every brick loose in the whole city. That's war, and that's every day life, Gene, and that's something the civilians had not seen in the World War. What's to happen in the future, no one knows; but we're trying hard, even reducing to so many lives for each enemy bomb.

I want above all things to let you know I'm hanging on like a good Chinaman, Gene. And while I'm unable to write to each and everyone of my good friends over there to tell them I'm alive and doing my bit, I pray of you to convey to them my very best greetings.

I received Mell's announcement of his marriage. The letter was forwarded and reforwarded until it was nearly six months before I got it. Kindly extend to him and her my very best as well as my wife's. Tell him I'll find the first opportunity to write to him direct.

Last August Holin's two sisters, Olive and Dolly, came to visit me in Hongkong. I wrote to them, but received no answer. Kindly call them

up and tell Elmer too that we are O. K. Shoan and Sanders and Rawls I want to send them my very best regards.

I moved my family down here in Hongkong, as I had no choice, I can't get my way around in the interior. I closed down my office and gave up the teaching job, school being moved to the interior.

How's your wonderful residence for the millionaire client? I'd give up a month's drinking to see some of your sketches. I haven't smelled architecture for nearly six months—how my hands ache for the touch of a pencil!

With very best regards to you and yours.

As ever,

Eugene Chin, B. S. Arch. '31

* * *

Sir:

I am very happy to enclose a check for my Alumni dues. At a future date, I would appreciate being reminded of the life membership plan in the Alumni Association.

I have been doing a great deal of traveling in the capacity of a Field Representative in the Technical Products Dept. of Shell Petroleum Corp., St. Louis, Mo. So far I have been traveling in the states of Louisiana, Alabama, Mississippi, Ohio, and Michigan.

I wish to send greetings to all my former instructors and professors at the Institute.

Sincerely,

Richard D. Armsbury, B. S. Chem. E. '35

3745 W. Lindell Blvd., St. Louis, Mo.

* * *

Dear Sir:

I have been transferred from Chicago to Cincinnati. Please change your record so that future issues of the ENGINEER *will be sent me at 3552 Kroger Ave., Cincinnati, Ohio, instead of 6315 Harper Ave., Chicago, Ill.*

My transfer here by the H. H. Robertson Co., for whom I work as a sales engineer, was a nice promotion—more responsibility and more pay. I believe this is due in part to the training I received while at Armour, even though I did not graduate.

Yours for a bigger Armour Tech.

Harold E. Cox, Ex. Mech. E. '35

Dear Professors:

In the last few years I have tried to write you many times but could find very little to write about until reading the article "Opportunity" by W. J. Cameron, in the March, 1937, issue of the ENGINEER AND ALUMNUS. *This article, to my way of thinking, is worthy of comment and might be a worthwhile reference to all men with a viewpoint that opportunity no longer exists. I say this because up to a few short months before reading the article, my view on the subject had been that opportunity no longer existed. In the latter part of 1936 I had a few offers in my own field, but not having had enough experience in the one and being too young for the other I found myself out of work at the end of the year. In January, 1937, I was offered a position with an up-and-coming concern which was a real opportunity but not in my field and not what I had worked for, nor what I had dreamed about. As a matter of fact I almost turned the job down because I thought I wouldn't like the work and was more or less set on getting into the general contracting business. Upon mutual agreement I was to give the job a trial, and to this day I have never regretted making the change and taking up an opportunity of a life time.*

This past year I travelled by car about 30,000 miles, covering a territory from Iowa to New York and from the Canadian border to the southern part of Mississippi, some weeks putting in as many as 100 hours. The two most outstanding trips of the year were made into Mississippi and New York. On the first I covered 1,800 miles and completed two deep well turbine installations in six days. On the second I spent a week around Seneca Falls and on the way home made a deep well turbine installation in Hornell, N. Y., and after running the field tests, left for Chicago driving a distance of 660 miles stopping only for meals and refueling. Hurry-up trips such as the above are made necessary because of the nature of our business.

Since the first of September our firm has assumed the active management of the J. P. Miller Artesian Well Company, and with this connection my work is getting more and more interesting every day. I now have the opportunity of selling as well as designing in addition to supervising the installation of deep well turbine pumps, the construction of deep wells, and the making of soundings for heavy foundation work. In the latter connection, Professor Ensz might be interested in knowing that one of his

students has just finished making a study of the sub soil conditions in Indiana Harbor for the Inland Steel Company. This particular job took about two months of intensive field work. At present we are about to move our equipment on another sounding job in the Chicago area. On looking over some of our records I find that our firm did most of the sounding for the proposed Chicago subway.

So much for the present. After leaving Armour I spent about two years with the American Telephone and Telegraph Company, one year with my Dad in the general contracting business, until rents started falling. Then in 1933, about 20 former Armour men organized the Century of Progress Guides Band of which George Bonvulet was director and myself drum major. After that adventure I worked for two years with Sloan & Cook, consulting engineers in public utility appraisals, until six months with General Houses, as associate to Harold B. McEldowney, in charge of erecting Steel Houses. By the way, you list Mac as a missing Arch. of '20 class. Well, Mac lives on 2403 Hartzell Road in Evanston. Then in January, 1937, Sloan and Cook gave me the opportunity of my life, which I have covered above.

Before closing I would like to take this opportunity of thanking Dean Heald and the many other professors for the wonderful way in which they helped when jobs were few. I have always found the dean's office open when help was needed and must apologize for not stopping in lately, but really my time has not been my own for the past year. It is my sincere wish to attend the Alumni Spring Banquet and a few of the many affairs you have arranged for Home Coming Week. Enclosed you will find a check for the first installment on a life membership in the Alumni Association. Although this installment has been on the way for a number of years, I am sure the final payment will be made before the year is over.

Sincerely yours,

Morris O. Nelson, B. S. Civ. E. '30

* * *

Dear Sir:

I have just received the March issue of the ENGINEER *and certainly wish to compliment you and your staff on the excellent publication. It surely is "newsy" and most interesting.*

As you probably know, I have been with the American Manganese Steel Division, Chicago Heights, Illinois, since last June, handling their apprentice training program. It offers a lot more possibilities for the future, and is certainly much more interesting than teaching high school. The steel

game is certainly exciting and most fascinating.

I did not receive a copy of the December issue of the ENGINEER, *and would certainly appreciate your sending me a copy to complete my file, as I keep all copies for reference on technical articles and Alumni news.*

Sincerely,

W. R. Manske, B. S. Civ. E. '30

* * *

Sir:

Please find attached hereto the questionnaire filled out to the best of my ability. Also please note that I am enclosing Dominican stamps in value of twenty cents, which I doubt you will be able to use, but, nevertheless, you may pass them on to someone who is collecting stamps, and at the same time, I am complying with the request of including stamps for mailing.

Furthermore, please find attached hereto my check for $5.00 to cover Patron Listing, but as no space is provided to show this, I am calling this to your attention, and hope to receive the De Luxe Edition, as stated under "Distribution."

I personally feel that you are doing a wonderful pob as Secretary-Treasurer of the Alumni Association, and I look forward with great interest to receiving the ENGINEER *and most thoroughly enjoy the Alumni section, which enables me to keep track of my old classmates, whom I hear of very seldom.*

Furthermore, I feel that your recent work has done more to cement the bonds of good fellowship among the alumni than was ever thought before. I know that each individual feels the same way I do; so once again, please accept my sincerest congratulations from an Armour graduate in foreign work.

Sincerely,

E. S. Geiger, B. S. Elec. E. '29
Santiago, Dominican Republic (West Indies).

[Editor's Note: On November 17th we received another letter from Mr. Geiger stating that he had been transferred to Jamaica Public Service Company, Ltd., Kingston, Jamaica, B. W. I.]

* * *

Dear Sir:

I received your letter and enclosed card this morning and am returning the card duly filled in. When the Directory is issued, will you please see that I obtain a copy? I'd like to know what some of the others whom I knew are doing.

Since leaving Armour, as you know,

I've done several things—finally graduating from the University of Illinois in Accounting in January, 1936, after having amassed a few honors while there. I came directly here to the General Electric Company, Bridgeport, Connecticut, where I seem to be temporarily settled as assistant to the Supervisor of Costs, if that isn't a paradox. I'm expecting to be transferred to Schenectady within a few years.

There are a couple of other Armour Theta Xi's here. I believe you were through here last year. Sorry I missed you, as I was in Hartford for the day. Maurice Tracy is here in the Personnel department, and Boyd Hindman is a salesman with Stewart Die Casting Company. I saw Bob Brummund last summer when he was visiting Tracy. I also see Jim Crabb each time I'm home. Guess that's about all the news. If you should be around again, remember I'm in the telephone directory.

With best regards,

Clarke L. Shabino, Ex. Civ. E. '29

* * *

Dear Sir:

I was very sorry to receive the enclosed announcement, telling me that I have not given you the information for the Alumni Directory.

As you will see, I am still in St. Louis, but have left the Knapp-Monarch Company to start a business of my own, the Thomas Products Corporation, manufacturers of quality wood products.

I was in Chicago over the Fourth and saw Harry Eichin, who gave me a first-hand report of the Reunion of the Class of 1928. I am sorry to have missed it.

With best regards, I am,

Yours sincerely,

W. E. Thomas, B. S. Mech. E. '28

Thomas Products Corp., 200 Chouteau Ave., St. Louis, Mo.

* * *

Dear Sir:

Thanks for your statement on dues. It is just one of those things that is so easy to let slip. In the very near future I will straighten this out with a life membership.

This is my second time in Detroit. I am back in refrigeration after a few months in the washing machine business. I am a refrigerating engineer at the Universal Cooler Corporation.

I don't get to Chicago very often and when it is possible it is usually on Sunday. I have hopes of dropping in at "33rd and the Tracks" soon.

Sincerely,

Perry C. Hall, B. S. Elec. E. '27

Dear Sir:

Enclosed please find my belated re-turn of questionnaire sent me some time ago. Pressure of other thing rather than lack of interest is th only excuse I can offer for my neg lect in this matter.

I was particularly glad to learn the recent establishment of a depar ment of public relations at Armou and of your appointment as its hea May I congratulate you upon this an wish you much success in this worth while effort.

We engineers have a very defini public responsibility, and our value the community is measured by th manner in which this responsibility undertaken. While few of our prob lems are purely technical they all ca for sound judgment to effect solutio As engineers become conscious their duty as citizens their value w be recognized. Only in this way c we hope to regain the place of leade ship too largely usurped by o friends in the legal profession.

The Armour Engineer *is receiv regularly and read with interest. is indeed a very creditable publicatio*

With kindest regards, I am,

Very truly yours,

G. F. Irving, B. S. Mech. E. '13

[Editor's note:

George F. Irving is now Vice Pre ident of the Empire Water Wor Supply Co. of Canada, Ltd., 1 Ethelbert St., Winnipeg, Man., Ca ada.]

* * *

Dear Sir:

I regret very much the long a sence in writing to you. I hope y are getting along as full of vigor ever.

From all indications, according the Engineer and Alumnus, *you a going to have quite a school. Mo power to you!*

Together with my past alumni du of $2.00, I am enclosing herew money order for $5.00 which cove dues for three years hence.

In spite of the present recession business, I am still forging ahe Since the publication of my little n to you in the Engineer and Alumnus, *I have had several letters fr my old friends and classmates of t Institute. It certainly was a ple ure to hear from fellows like A. Wolf, L. Beckman, and Verner H lund, who are all getting along s cessfully. If everything goes alo fairly well, I should like to visit Institute sometime in the near futu*

Wishing everyone of you my fo aloha, I am,

G. I. Nakayama, B. S. Elec. E. '3

Dear Sir:

When I was in to see you recently I promised something in the line of a written account of our group reunion, so "Voici!"

Forseeing that I would be in Chicago on the week-end of September 10 I dropped a couple of postcards to the boys in Rock Island and Davenport about the middle of August, suggesting the possibility of a visit. Bolton and Stocking in turn contacted Lester and Kettlestrings, and the latter two arranged for a reunion of the Civil Department Class of 1935 at my home on Sunday, September 10, 1938. It was a bit of a surprise to me as my time had been so fully occupied that such plans had not occurred to me. Consequently, when the boys started dropping in Sunday evening, it was a real treat.

Ten out of the eighteen in our class showed up—along with Professor Penn, who has attended each of the three get-togethers we have held since graduation. Principal activity of the evening was a gab-fest which was heartily enjoyed by all participants. Discussion of the various work, old friends, school, the fishing at Trout Lake, etc. helped work up an appetite—a contingency foreseen and provided for by the hostess and her aide, Mrs. Nelson and Mrs. John Curran, respectively.

Present at this meeting were the following: Prof. J. C. Penn, Howard T. Bolton, John Curran, Milton L. Edgren, Barclay V. Jones, D. W. Kettlestrings, Albert W. Lester, George A. Nelson, Harold Olson, Kenneth O. Stocking, and George O. West.

Chedo Graham sent his regards, explaining that participation in a radio broadcast and reception prevented his appearance.

Charles Thompson was reported to have recently acquired the title of "husband"—and, not being present to deny the allegation, was written off the "die-hard" list.

Rigoni, Bernstein, and Gregarson when last heard of were employed by the Illinois Highway Department, and are presumably still there and satisfied.

Joseph O'Connor is still conditioning Chicago's foul air at the job he started shortly after graduation.

Leonas, it was understood, is desirous of improving his position.

Nick Maurer could not get up to Chicago for this reunion. He is still employed as a Topographical draftsman at the U. S. Engineer Office, Rock Island, Ill. A family man, of course, with a bouncing baby boy about 2½ years old, born "down south" when Nick was working at Vicksburg, Miss.

John Curran is the "old married man" of the crowd, with Howard Bolton a close second. Both have been married over five years—but both have to surrender the palm when it comes to families, neither having started yet. The latest addition to the Armour Class of 1958 is that of Harold Olson, who has been married a little over a year. Good start, Ole! Has a good job as Project Engineer at the Chicago Municipal Airport.

Howard Bolton had a bit of tough luck recently with Old Man Illness hitting both him and his wife, but Howie came back in the last round to score a knockout and is now headed for the top again. Both he and Kenneth Stocking report recent advancements. Stocking is employed as a Junior Engineer in the Design Section and the U. S. E. O., Rock Island, Ill. (at present worrying about the design of some welded Taintor gates). Bolton is a Junior Engineer in the Lands Section at Davenport, Iowa, writing descriptions of property.

Kettlestring complacently reports no change since the last time we gathered. Getting used to both married life and the draftsman's table at the Mississippi Valley Structural Steel Company.

Barclay Jones is one of the pioneer time-study men from Armour—that work being introduced about the time we went "through the mill." Spiegels, Inc. likes his work. Says he's not married yet, but still has hopes. Suspect he may "aisle-amble" soon.

George West is another of the satisfactorily married clan. He says a year isn't near enough—wishes he'd started much sooner.

Albert Lester was married last May. Spent his honeymoon touring the central southern states, stopping in to see me in Vicksburg (Al's old stamping ground). Though well employed at present, I suspect he would welcome an opportunity to return to the sunny south. It gets one after a while.

Milton Edgren, another former resident of Vicksburg, has also found himself a bride since returning north to take an air conditioning job with the Pullman Company. The Armour men have a noticeably low score when put up against the southern belles—wonder why?

Completing the roll, I can be more explicit as to my own record. Two and a half years in the south have thinned my blood, but I'm still a "damnyankee," and expect to remain such. I have managed to run the ga-

ment of activities, from coaching a girl's high school track team to winning a place on the Mississippi State Civilian Rifle Team which was sent to Camp Perry, Ohio, for the National Matches held during August and September.

I was recently promoted to Project Engineer in charge of the East River, New York, model at the U. S. Waterways Experiment Station. A bit of hiking, fishing, swimming, scout work, softball, club work, and higher mathematics occupy most of my non-working, non-sleeping hours. The last named gets a fair share of my time during the latter part of each month, but so far I have evolved no formulae for stretching a government check.

My recent visit to Chicago was punctuated with numerous rumors regarding my marital status. They were grossly exaggerated—I deny everything including the three children.

For those with a statistical turn of mind, I present the following:

Eighty-three per cent of the class is engaged in work which is strictly engineering in character.

Fifty-five per cent of the class is selling its talents to some governmental agency, this group being divided in the ratio of 3 to 2 between Federal and State work.

Another fifty-five per cent of the group still resides in the Chicago area—the remainder being spread over four states. Contrary to expectations, however, government or private service does not control this factor.

This letter is perhaps overlong, and will take an undue share of the space allotted to Alumni news, but before closing I wish to convey the best wishes of the entire Civil group of 1935 to President Heald and to the various faculty members whose lot was made so much easier when we finally qualified for such reunions as inspired this missive. It is always good to hear of the continued progress of the Institute, especially to those of us who can visit the campus only infrequently.

Yours for a bigger and better Armour,

George A. Nelson, B. S. Civ. E. '35

* * *

Dear Sir:

Sorry I have been negligent in answering your letter of October 10, but now pay day has come so I am in a position to answer in full. I am enclosing a five dollar money order to pay my association dues for the past four years and also to take care of the current year.

Life goes on up here as well as can be hoped for. I am quite satisfied with 'married happily' as a classifi-

cation. [Art was married to Miss Royetta Smith of Madison, Wis., on June 22, 1938.]

One of these days I hope to get to Chicago and will look forward to seeing the school and renewing friendships again. . . .

Arthur L. Steinhaus, B. S. Fire P. E. '33

* * *

Dear Sir:

The last few issues of the ENGINEER, *which you kindly forwarded to Tokyo, finally reached me in Baltimore, Maryland.*

I returned, via the Trans-Siberian Railroad, from the Orient in 1930, where I spent three years with the International Telephone and Telegraph Company, and had an interesting visit in Europe, saw my parents and sisters, and also had the good fortune still to find our old friend, L. C. Monin, in Zurich. Presenting him with a little ivory carving, he heartily laughed at the thought that he, like the artist, often succeeded in finally making a thing of beauty out of solid ivory.

Since my return to the States, I have been engaged in engineering work at the Baltimore Works of the Western Electric Company, which is the newest and most specialized of all of their plants, located on Chesapeake Bay and in the heart of the most interesting section of the country. Drives into Virginia in the spring, ocean bathing and fishing in the summer, hikes in the Blue Ridge mountains in the fall, and winter sports in the Alleghanies are all within easy reach of Baltimore, which is itself a most enjoyable spot on earth in which to live.

The Alumni Notes in the October '37 issue are of real interest, and the whole issue is a splendid job.

I am enclosing check for past dues and wish to be remembered to all my old friends.

Sincerely yours,

Carl O. Haase, B. S. Elec. E. '16

* * *

Dear Sir:

I have received every issue of the ARMOUR ENGINEER AND ALUMNUS *and read it from cover to cover—even the advertisements. I am employed as a Junior Highway Engineer for the Illinois State Highway Commission at Elgin, Ill.*

Theodore S. Ramotowski, B. S. Civ. E. '36

* * *

Dear Sir:

While in Chicago this past summer, I discovered that I was among

the missing. At present, I am assistant superintendent of the White Furniture Co., located in Mebane, North Carolina, and having a force of approximately 250 men.

I would greatly appreciate receiving the Armour Engineer *again, to keep up with the rapid progress that Armour Institute is making. Likewise, I would appreciate a directory, if one is available.*

Sincerely yours,

Harold R. Davis, B. S. Mech. E. '32

* * *

Dear Sir:

We had occasion recently to peruse the Armour Engineer *and its new suit and overcoat. We think it an excellent piece of work and take this opportunity to congratulate you, and also respectfully request that we be put on the mailing list.*

Kenneth V. Hall, B. S. Fire P. E. '17

[Ed. Note:

Kenneth V. Hall has an Insurance Agency in Rockford, Illinois.]

* * *

Dear Sir:

The Chemical Engineers of 1936 held their fourth reunion at the Chicago Engineers Club on Friday evening, August 19th.

Our class is organized, under the name Chemalumn, in a way that we hope will keep it intact throughout the years to come.

The data of the reply to a questionnaire that we distributed to our thirty-five members will be of some interest to you: The average salary of a member of Chemalumn for the two years since graduation was $148 per month. The average monthly salary for the coming year is $149. 11 per cent of our members are engaged in academic pursuits, 25.8 per cent in operation, 5.7 per cent in design and research, and the remainder in sales, management, etc. 14.3 per cent have M. S. degrees, and 8.6 will have Ph.D. degrees.

An important part of the business transacted at the meeting was the establishment of a Chemalumn Employment Service—wherein all members will communicate leads to jobs to the secretary. The secretary will act as a clearing house and pass on the leads to the men who he knows are applicable.

I hope that this information concerning one of the most active classes of Armour will interest you.

Yours truly,

Otto Zmeskal, B. S. Civ. E. '36

[Ed. Note:

Otto Zmeskal is a B. S. Ch. E. of 1936. He received the Master's degree from Armour, and is now working on his Ph.D. at M. I. T.]

* * *

Dear Sir:

I had intended writing long ago t tell you something of what I am do ing here with the Humble Oil and Re fining Company, but because of th fact that I seem to have more letter to write than time permits I just didn seem to get it done.

I have been with the company no for about seven months. I have jus recently been transferred to the En gineering Dept. This departmer boasts of men from many famou schools, such as M. I. T., Tulane, Ric Institute, Cornell, University o Texas, and Texas A. and M. Until few weeks ago I worked as an ele trician's helper, and did actual co struction work in the addition of third turbo-generator unit to ou 30,000 KW power plant. Refinery e gineering is really a very broad su ject, however, and I am studying r fining equipment and processes in ev ing school classes.

In closing I wish to compliment yo upon the excellent quality of th Armour Engineer and Alumnus *o the past year. I also wish to voi my approval of the organizing of th Research Foundation.*

Please note my change of addre and find enclosed a money-order payment of my dues for last year an for the current year.

Sincerely,

Thos. M. Hoffman, Jr., B. S. Elec. '36

Baytown, Texas.

* * *

Dear Sir:

I received your letter and enclos blank and was very pleased to kno that Armour is publishing a directo and I know that I will enjoy looki through it to see what my friends a doing and where I can get in tou with them. I am planning to be hom soon.

After typing the required inform tion on the blank which you sent m I felt that maybe I had better t you something of the type of work am doing so as to leave no false i pressions. Since last June I ha been in the Engineering Dept. of Ge eral Electric Company in Pittsfiel Mass. My work consists of maki rough designs of transformers fr 500 to 5000 kva for drawing up t specifications for the transforme We make a rough design so that can guarantee losses, efficiencies, a regulation, and give them approxima

mensions and weights. We also have estimate the costs. This work has en very interesting and has involved good deal of engineering. I am now the High Voltage Research Labora-ry making lightning investigations bushings and transformer wind-gs. I expect to be here for about six nths and then I will go back to e Engineering department.

Sincerely,

onald C. Graham, B. S. Elec. E. '36

Harvard St., Pittsfield, Mass.

* * *

ar Sir:

I am enclosing with this letter a eck for $2.00 for my dues in the umni Association for the years 37-38 and 1938-39. I would like be kept informed as to anything the sociation is undertaking.

The above address (202 W. Broad-y, Fort Worth, Texas) will be good, hope, for at least several months. any rate, I can always be reached rough my home address which you ve in your files. (11 Prairie Ave., ghwood, Ill.)

I have been in Texas for two weeks, w, and so far have found every-ng to my liking. At present I am gaged in research work, which is e type of work I have always nted to do.

I intend to keep the Association in-rmed as to my whereabouts and my rk, as I have no desire to be listed ong the "lost souls" in the ENGI-ER AND ALUMNUS.

With best wishes for all Alumni dertakings, I am,

Sincerely yours,

omas M. Gilkison, B. S. Civ. E. '36

* * *

ar Sir:

Perhaps you would be interested to ow, as a matter of record, what I ve done with my time since I grad-ed forty years ago.

After graduating I was assistant to Secretary of the Illinois State ard of Architects' Examiners. I left s in October, 1898, and went to skegee, Alabama, where, at first, I ght mathematics, physics, and mistry. I was transferred after a r to the mechanical department to ome the Drawing Instructor for the s taking the metal trades and ma-ne designing in the department. I s at Tuskegee from 1898 to 1905. n 1906 I came to Baltimore to ch machine practice and forging d to assist in mechanical drawing one of the high schools. While I s thus engaged, I was studying methods in physics and chemistry with the hope of teaching them. Well my chance came and I went on from that to become Head of the Science Department until diabetes, deafness, and a stiffness in my right hand compelled me to retire in August, 1937. I can't write very much now as you can readily see from this letter.

I hope that you will be very successful with the Directory. I think it is a very fine idea.

With best wishes for all the success possible, I am,

Very truly yours,

John J. Wheeler, B. S. Mech. E. '97

* * *

Dear Sir:

I've been working for Remington Arms Company, Inc., located in Bridgeport, Conn., since July 15th. I like the job, and I believe that the organization likes me. To date, I haven't made any startling achievements, but I've been learning a lot. I work in the plant among the machines, and sometimes I really look like a good mechanic. On the average, I spend a week in each department learning the operation of the machines and attempting to see industry from the laborer's point of view. All this time I've been in the plant manufacturing metallic ammunition, from twenty-two caliber cartridges to fifty caliber machine gun cartridges.

Four students were selected this year out of approximately two hundred applications; I feel that I am very fortunate. The other three fellows are from Stevens Tech, Maine U., and R. P. I. The Student Training idea was instituted at Remington Arms five years ago, and at the present time there is an average of three men per year working for the Company. Every week on Thursday afternoon, we meet with our director and discuss various problems and questions.

I am living in a rooming house owned by a minister; four of us live together in two connecting double rooms. Two of us are manufacturing students at Remington, the third is a fellow from Purdue who works in the Remington Research Lab., and the fourth works for Traveler's Insurance. All of us graduated from college this last June.

I am kept quite busy with reports on my activities at the plant and with outside reading on various phases of management and production.

Yours very truly,

William J. Chelgren, B. S. Mech. E. '38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1344
There's a lift in the voice that says —"Pabst Blue Ribbon, please"— and a nod of approval from the one who serves it. Pabst has won such acclaim through five generations
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Order a Case Today
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Pabst
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PABST BLUE RIBBON BEER
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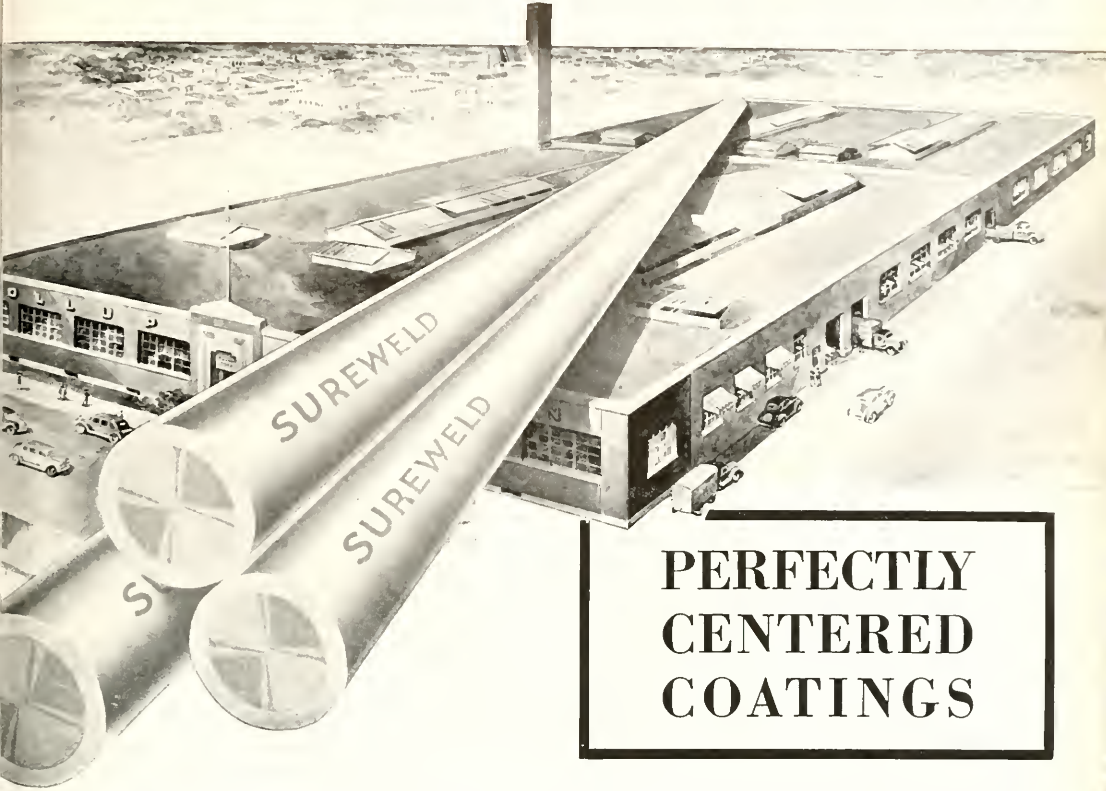

PERFECTLY CENTERED COATINGS

Iollup Sureweld Protected Arc Electrodes .re always concentric . . . the metal in the xact center . . . the coating uniform in hickness at all points.

'o the Welding Industry, this means larger utput, a saving in rods and operators' time, ower production costs and welds of quality.

Iollup perfectly centered rods avoid under-utting, eliminate unnecessary arc blow, pre-ent contamination of the arc and permit erfect fusion and evenly deposited metal.

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The work of this special equipment is constantly checked by an inspection staff on the job 24 hours a day. Tests are continually being made for concentricity, weldability, mechanical characteristics and chemical composition.

Due to the high physical properties produced by the Sureweld Protected Arc Electrodes they have passed all code requirements.

Demonstration

Hollup perfectly centered Sureweld Protected Arc Electrodes will be demonstrated for all applications upon request.

Products—a rod for every job in electric and oxy-acetylene welding—are available through 88 distributo

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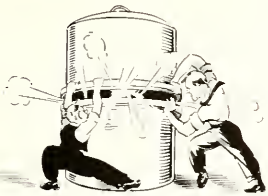
ARMOUR ENGINEER
AND ALUMNUS

MARCH 1939

G-E Campus News



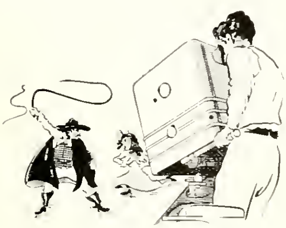
A BIG SQUEEZE

IT TAKES a lot of squeeze to put a 1,000,000-volt x-ray equipment in a container only four feet in diameter and seven feet long, especially when its less-powerful predecessors required a special building 62 feet long, 32 feet wide, and 36 feet high. But recently, G-E scientists applied the necessary squeeze and completed some surprisingly compact x-ray equipment.

Such squeezing naturally involves a few innovations in design. So innovations were introduced. The 11-section x-ray tube was put inside the novel transformer, in the space normally taken by an iron core. Gas having an impressive-sounding name, dichlorodifluoromethane, was used instead of oil as an insulating medium, 100 pounds of this gas doing the work of six tons of conventional oil.

Then the equipment was mounted in the grounded metal container, thereby enclosing the 1,000,000-volt circuit and eliminating the hazard of electric shock. Looking at the apparatus, you note a striking absence of moving parts, for the control of the apparatus is essentially electrical.

The first of the new units will be installed this spring in Memorial Hospital, New York City, providing medical science with another powerful weapon in its constant war on disease.



LIGHTS! ACTION! CAMERA!

IN A specially constructed room alongside the studios of the G-E international short-wave stations, the familiar words, "Lights! Action! Camera!" will soon be heard. For General Electric's new television station at Schenectady is nearing completion.

The television transmitter, perched atop the Helderberg Hills 12 miles outside the city, will be at least 250 feet higher than the station in the tower of the Empire State building, New York. And, broadcasting with 10,000 watts, it will be the most powerful television station in the United States.

There will be—literally—no strings to the transmitter. C. A. Priest, Maine '22 and an ex-Test man, Engineer of the Radio Transmitter Engineering Department of General Electric, has announced that an ultra-short-wave transmitter will be used instead of the usual cable to relay the images from the Schenectady studios to the main transmitter in the Helderbergs.

THE "HOUSE OF MAGIC" BECOMES TWINS

THE world-famous G-E "House of Magic" show has become twins. It had to, for it was placed in the predicament of having to be in two places at one time—the New York and the San Francisco Fairs.

One twin—directed by R. L. Smallman, Calif. Tech '33 and ex-Test man—is already holding court on San Francisco's Treasure Island, site of the Pageant of the Pacific. The other makes its bow April 30, opening day of the New York World's Fair. Its director is W. A. Gluesing, Wisconsin '23, also an ex-Test man.

The thousands of visitors to these Fairs will see such feats of modern magic as a voice-controlled toy train, a magic carpet, zigzagging pictures of sound. They will see the stroboscope, which makes it possible to see the spokes of a whirling wheel just as if the wheel were motionless. They will see a light beam sawed by the teeth of a comb.

However, entertaining as these demonstrations are, they represent far more than mere tricks of modern magic. They symbolize the work in pure science that is constantly taking place in G-E research laboratories—work which is the basis of General Electric's contributions to the world of the future.

GENERAL ELECTRIC

CHICAGO'S SKYLINE

■ JOSHUA D'ESPOSITO, PWA Project Engineer for the vast engineering program of the Chicago Subway System, has been in close touch with the planning and construction of the subway for many years. Mr. D'Esposito, a distinguished engineer, is well known for his work on many local and national construction projects, including the Chicago Sanitary District and the Chicago Terminal and Union Station.

■ CHARLES E. DE LEUW has been actively engaged in municipal, railroad, reclamation, and transportation engineering since 1906. He has made transit studies for Chicago, Los Angeles, Baltimore, and St. Louis. He was Assistant Chief Subway Engineer for Chicago, Assistant Chief Highway Engineer for Illinois, and a consulting engineer for the Illinois Commerce Commission. Mr. De Leuw saw World War service and received decorations for his participation in three major engagements in France. He is a member of numerous academic and professional societies.

■ JAMES L. KRAFT, founder and president of the Kraft-Phenix Cheese Corporation, invented the pasteurizing process as applied to the manufacture of cheese. He is a trustee of the Baptist Theological Seminary and a member of many organizations in Chicago.

■ DAVID F. NOLL, a Harvard graduate, has been connected with the WPA as the designer and planner of many of Chicago's professional, technical, and clerical projects, including the Armour Institute Air Pollution Survey. As an amateur photographer he became interested in the possibilities of microfilm for public office records, and he is now in charge of the Folmer Graflex activities in this field.

■ DAVID BAKER received his B. S. degree in Architecture from Armour Institute of Technology in June, 1938. Upon graduation he was presented with the American Institute of Architects Award for Scholarship and the Charles L. Hutchinson medal for the highest record in architectural design.

■ EDMUND M. ROOT is a native Vermonter, born and reared on a Vermont dairy and maple sugar farm. At present he is in the service of the Farm Bureau and Extension Service, as County Agent, in Windham County, Vermont, and, in this position, is close to the problems of the production and marketing of farm products.

■ We are indebted to the following individuals and companies for the use of the photographs: Mr. Philip Harrington, Commissioner of Subways & Traction, City of Chicago; the Federal Emergency Administration of Public Works, Chicago; Kraft-Phenix Cheese Corporation, Chicago; J. Walter Thompson Co., Chicago; Folmer Graflex Corporation, Rochester, N. Y.; The Architectural Forum, New York City; HADASSAH, The Women's Zionist Organization of America, New York City; Zionist Organization of America, New York City; State of Vermont, (Department of Agriculture, and the Department of Conservation and Development); Homer C. Forbes, White Mt. Studio, Littleton, N. H.; the Monfort Studio, Chicago; and Edward A. Center, '42.

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SOCIAL AND ECONOMIC BENEFITS OF THE SUBWAY TO CHICAGO

By

Joshua D'Esposito

A GOOD deal of skepticism has existed and still exists in the minds of many Chicago people regarding the construction of a subway for Chicago. There is some justification for this skepticism, and I am not at all surprised that the woods are full of doubting Thomases, because Chicago has been talking about a subway for over thirty years.

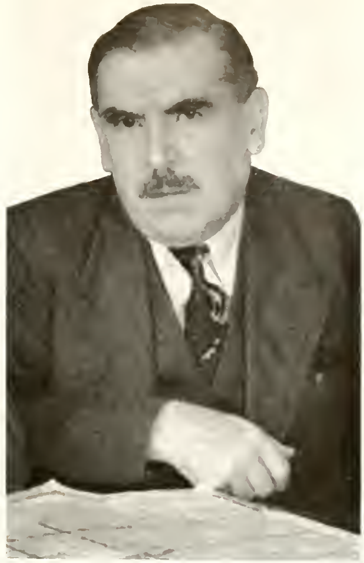
Important matters in times past have been talked to death, and it really looked as if something of that kind had happened to the Chicago subway proposition. It seemed as perennial a topic as the tariff and the weather, with the exception that occasionally something was done about the tariff, but never about the subway or the weather. Consequently, it was entirely natural for many people to believe that this time it was again a case of only discussion and the usual result of nothing more done.

But, fortunately, money talks. It is the loudest and most convincing kind of conversation. The Government presented a convincing speech when it gave Chicago $18,000,000 to put with the $22,000,000 of its traction fund, that has been accumulating in the past years, for the purpose of building a subway. When the Public Works Administration gives 45 per cent of the cost of a great project, it is necessary for it to see that the job is done, to require guarantees that the sponsor of the project can and will donate his 55 per cent of the cost, and to demand substantial and absolutely convincing evidence that the job will be finished within a specified period of time, and that the work will be substantially completed on a certain date, June 30, 1940, in this case. The City of Chicago is in partnership with the Public Works Administration to build this subway and has entered into solemn contract with the Government that the work will be finished and that it will be done according to the terms mutually agreed upon by the two contracting parties.

Since it was necessary to know exactly what Chicago wanted to do about the subway question, how the work was going to proceed, and how much the subway was going to cost, Mr. Harold Ickes named our Commission as a co-ordinating body. All of our members have had long years of experience in underground construction, the building of great sewer systems such as the Sanitary District projects here in Chicago, the New York subway, tunnels, and similar enterprises. Everyone who has given the matter any thought knows that there have been a number of plans for a subway system for Chicago and that there has been much discussion and controversy as to what was the best plan. Mr. Ickes asked us to stud the plans submitted by the engineer for the City, to work with them, an to agree upon plans which were i accord with the best principles c modern engineering construction an which would give Chicago the bes transportation system that could b devised and the greatest value fo the money it had to spend.

After an intensive study of th plans submitted, covering a period o over two months, the Commission re jected the two east and west subway for street car use for the reason tha at the present moment it is impossib to tell to what extent street cars ma or may not come into the loop, give a modern rapid transit transportatio system; also to what extent stre car service may be modified by th development of different types of su face transportation.

The Commission felt that und these conditions an expenditure o $11,000,000 for street car subway should at least be postponed until th future can develop and tell its stor It did not approve the City's propos for a so-called high level subway State Street from Lake to Van Bur Streets, but recommended in its pla a subway at the lower level whic could be built not from the surface b by boring horizontally under th street, limiting the surface work to t



Joshua D'Esposito

›enings necessary to develop the re-
ıired stations. The reasons for jus-
fying such a recommendation are as
·llows:

1. The least amount of interference
the normal business of State Street
as desirable.

2. The subway proposed by the
ity would necessarily have involved
e destruction and reconstruction of
ery single public service facility in
e whole of State Street and to some
tent facilities running east and west
street crossings, all of which work
impossible of accurate estimate, and
ow and expensive. The City had not
ached an agreement with the owners
the public utilities, and under any
rcumstances a practical solution of
e problem would have involved ex-
ssive details.

3. The City's design contemplated
e use of two tracks in State Street
ith separate platforms, each plat-
rm leading to one side of the street
ly, so that a person finding himself
the west side of State Street and
anting to take a north bound train
ould have to cross State Street on
e surface. Also under this arrange-
ent each station would require sepa-
te controls for each track. This
rangement was considered unsatis-
ctory and not as desirable as an
rangement with a single station leading to both tracks from a common control.

In order to accomplish this the Commission recommended placing the subway tracks at approximately the same level as those proposed in the design of the subway made in 1930, which design provided for a continuous mezzanine above the tracks for the full length of State Street, that connection between a station immediately below the street and the platform level be secured by use of escalators and stairways.

It was also felt that a subway in State Street stopping at Chicago Avenue would not accomplish an adequate service from the standpoint of rapid transit in actual time saving for the users of the facility and for that reason recommended the extension of the subway under North State Street to Division Street and under Clybourn Avenue to a connection with the elevated in the neighborhood of Willow Street elevated station. By the construction of this extension the subway service will dispense with the use of a section of the elevated system having short radius curves and in general a very poor alignment which limits the speed of operation.

In order to begin construction of the subway serving the West Side the Commission studied and recommended a portion of the West Side project consisting of a subway under Milwaukee Avenue from Ashland Avenue southeast to Lake Street and then under Lake Street to Dearborn Street and south on Dearborn Street to Congress Street. This subway project has been recommended in the past and to that extent is not entirely a novelty, the only new feature being the extension to Congress Street and the proposed west leg of the subway under Congress Street which does not now exist.

I am asked what are the benefits to Chicago of building a subway. I would answer that the first benefit is that of forcing a solution of the traction problem that has vexed Chicago and hampered its advance for years. Negotiations for the settlement of the traction problem had come to the usual deadlock until the Commission came out and recommended the immediate building of a definite system of subways, which, in order to perform its maximum service, would have to be operated as a part of a comprehensive transportation system.

When the people of Chicago expressed their approval of the advice of the Commission, the responsibility for delay in the solution of the transportation problem was placed squarely on both the City and the owners of the various properties, with the result that no one was willing to stand out

as responsible for throwing a monke wrench into the machinery of nego tiations and depriving Chicago of th $18,000,000 from the Governmen and a subway system. In all likeli hood a solution of the traction probler will be found. and indications are tha it will be in the very near future.

The most immediate and direc benefit to Chicago is, of course, th expenditure, in a short period of tim of $35,000,000 out of the $40,000,00 in the Chicago district, giving employ ment to many in every profession an trade. The expenditure of the tota sum is divided about fifty-fifty be tween material and labor, but labor, anything, will have the larger shai in the expenditure. The subway pro vides a great market for both lab and materials. According to the Bu reau of Labor Statistics, for every ma hour of work on the subway there a developed more than two and a ha man hours in the industries providin the steel, cement, and other materia for the construction work. The subwa itself will give employment to mo than 7,000 men; these, with the tho sands working in factories, mills, an mines, who are engaged in providin the materials, bring the subways co tribution to employment to abo 25,000 men.

The above are only the most obvio of the direct benefits. There are st millions of dollars worth of benefi that are difficult to estimate, and whi I haven't considered in the abo figures on the effects of the subway industry. It will stimulate a treme dous amount of building of stores an buildings along the subway route. State Street, where there is to be o continuous loading platform, eve store will have to remodel its fro its entrance, and adjust itself to t benefits of the new subway. There a great deal of employment for arc tects and builders in this one featu for at least one story of each buildi on both sides of the street will rebuilt as each store will undoubted want an entrance into the subway.

Another item which provides an a ditional benefit is the amount money spent by the lessee of the su way on equipment. The original $4 000,000 provides only for the co struction of the subway, and an ad tional five or six million will have be spent by the lessee for trac signal systems and station outfittin There will also have to be new ca purchased since most of the prese cars cannot be used in the subway. is quite obvious that a project of th type is a tremendous impetus to bu ness. No one can estimate just h far it goes, for it spreads out in t many directions.

More than anything else, however. I believe that the greatest benefit will turn out to be the rebirth of the Chicago spirit and the Chicago faith in its own future. Great private and public projects in this, the second city of the United States, have been very scarce in the last eight or nine years. In fact we have lagged far behind every other large city of the world from the standpoint of public and private improvements, since 1932.

The benefits derived in the immediate future from the subways are perhaps the most important to us now, but this is no excuse for omitting plans for future development. It was necessary to study all existing and proposed plans to cover the present and future transportation interests of the entire city. The subways which are under construction are only the start, we believe, of a great transportation system to cover the entire city; the backbone of the system yet to be built. Plans were considered by the Commission which should give greatly needed relief to the vast areas of Chicago's West Side now suffering from inadequate transportation, where good transportation would go far toward redeeming our blighted areas surrounding the loop. In the light of these needs the present subways are being built to connect directly with such future improvements as a Congress Street subway, a highway, or perhaps both.

Chicago's subway will have an enormous influence on the path of the future social and economic development of the city. The new system will affect the movements of population, for with individual motor transportation and the superior transportation facilities furnished by suburban steam railroads, the trend has been for movement farther and farther away from the heart of the city and to the suburbs. The new rapid transit facilities furnished by the subway, which have been lacking in the past, will, it seems to me, encourage a movement back towards the city as new residential districts are developed. Planning within the city proper will unquestionably be affected by the construction and use of the subways. With transporation developments of the future growing out of the present beginning, great areas which are now not desirable as residential districts are almost certain to be developed, and with better housing and transportation facilities there will be many new residential districts created. The Commission studied the Burnham Chicago Plan and found it still the greatest plan of its kind in existence. Its lines could well be developed and brought

(Turn to page 57)

Upper Left: The dedication parade through the Loop—December 17, 1938. In the middle background is part of the loop elevated structure that will ultimately be removed.

Middle: Dedication ceremonies marking the start of work on the State Street tube on December 17, 1938.

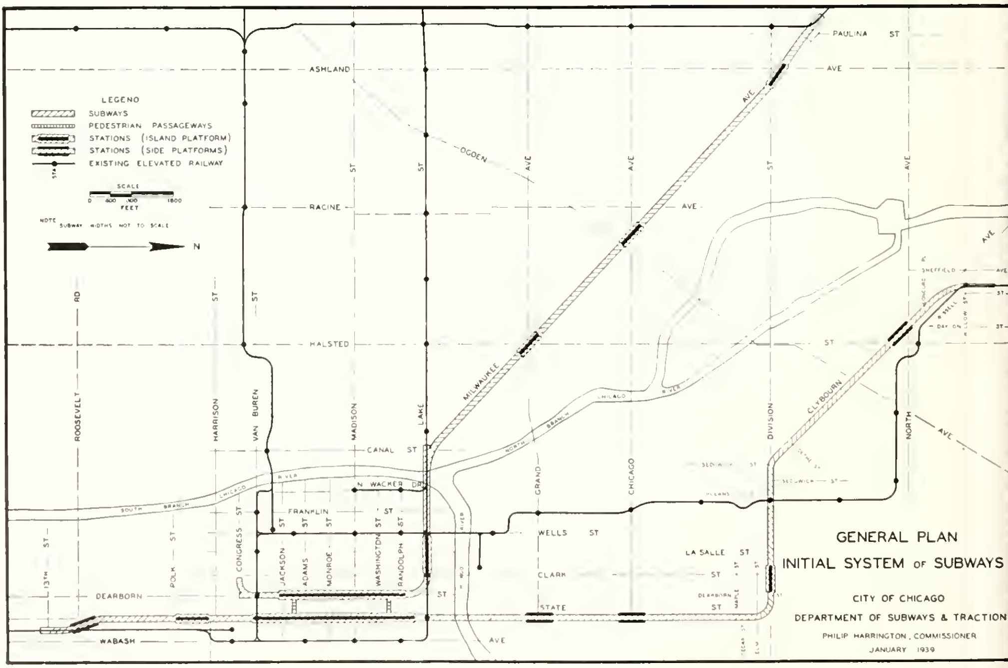
Lower Left: Inspection of the shaft during the first days of excavation.

Below: Two views of the vertical shaft, through which all of the material excavated will be brought to the surface. The location of this exit to the surface is such that the constant movement of trucks will not affect the normal city traffic.

CHICAGO DIGS A SUBWAY

By

Charles E. De Leuw



It is somewhat difficult to develop in a brief article the full significance of the initial system of subways to the City of Chicago. Many complex problems of engineering, operation, law, and finance are involved—not only with respect to local transit—but also to the entire social life of the city. The subway will have a profound influence on the future growth and prosperity of the central business district, as well as on the numerous commercial and industrial sub-centers throughout the urban area. For the purposes of brevity and clarity I have formulated questions covering various phases of the subject—the answers to which may afford a somewhat fuller understanding.

What Is the Initial System of Subways?

The pattern of the initial development conforms in general to the more important plans which have been advanced for transportation subways since 1916 (see Plate 1). While an agreement has been secured from both the Chicago Surface Lines and the Chicago Rapid Transit Company to operate the initial subways in the event that there is no consolidation of these properties before their completion, the structures are planned for rapid transit operation and are designed largely as terminal subways calculated to relieve the present congestion on the Elevated-Union-Loop structure.

State Street Subway, Route No. 1, is a two-track structure extending from a connection with the four-track North Side elevated railroad north of North Avenue, thence along private right-of-way to Clybourn Avenue, thence along Clybourn Avenue, Division Street, State Street, and along private right-of-way to a connection with the three-track South Side elevated railroad near 14th Street. Stations are located as follows: at North Avenue, Halsted Street, and Clybourn Avenue; at Division Street and Clark Street; at Chicago Avenue and State Street; at Grand Avenue and State Street; a loop station extending from Lake Street to Van Buren Street; at Harrison Street and State Street, and at Roosevelt Road and State Street.

The total length of the route is 4.22 miles, and the total estimated cost is $21,750,000.

Dearborn Street Subway, Route No. 2, is a two-track structure extending from a connection with the Logan Square elevated railroad near Milwaukee Avenue and Paulina Street, thence in private right of way and in Milwaukee Avenue, Lake Street, and Dearborn Street to Congress Street. Stations on this route will be located at Division Street, Ashland Avenue, and Milwaukee Avenue; at Chicago Avenue and Milwaukee Avenue; at Grand Avenue, Halsted Street, and Milwaukee Avenue; at Lake Street and La Salle Street, and a loop station extending from Randolph Street to Jackson Street.

The total length of Route No. 2 is 3.34 miles, and the estimated cost is $18,250,000.

A tunnel will be provided for each track—approximately 15 feet in width and 17 feet in height. In general, the cover over the top of the tunnels will range from 20 to 25 feet. At certain locations north of the Chicago River, twin tubes will be built with a common center wall, and at stations the tunnel section will be a multiple arch structure with overall dimensions of 58 feet by 24 feet—accommodating two 12 foot side platforms 500 feet long (see Plate 2). However, throughout most of the project the tubes will be separated so as to provide for a single island platform at stations. In the loop district, island platforms will be 22 feet wide providing an overall width of tunnel of 53 feet (see Plate 3). At outlying stations island platforms will be 18 feet wide, with a corresponding reduction in overall width.

Entrance to platforms will be through stations located at mezzanine level about 18 feet below curb grade. These stations will vary in size, depending on the location and probable volume of traffic. In general, they will extend at least from curb to curb connecting to stairways from the sidewalk on either side of the roadway with a length measured along the subway of 50 to 75 feet. Liberal use of escalators is planned to facilitate movements between the mezzanine and station platforms. At all of the outlying stations there will be at least one escalator for each platform. Mezzanines will be provided in the loop district at the center of each block, affording adequate distribution of passengers over the continuous platforms, and two escalators are planned at each mezzanine.

The type of section adopted, where trains will operate through separate single track tunnels, provides a piston-like action and greatly facilitates the problem of ventilation. Openings in the tunnel section connecting to shafts and to gratings in the sidewalk—will be made on the inbound tracks just in advance of the end of station platforms. These vents will relieve the air pressure caused by the movement of trains at high speeds and will effect a measure of positive circulation. At loop stations, this natural ventilation will be augmented by exhaust fans connected to ducts located under the platform and to louvers in the mezzanine level, providing for change of air six times per hour. This system of normal ventilation will be supplemented by emergency ventilation units consisting of large exhaust fans located midway between stations—to be operated only in case of fire—with capacity sufficient to clear the entire subway section of smoke in five minutes.

All subway entrances, stairways, mezzanine stations, and platform sections will be provided with a suitable and attractive station finish. Subway entrances will be uncovered, and the conventional kiosk used in the earlier New York City subways and similar to those of the Illinois Central pedestrian tunnels across Michigan Avenue, will be missing in the Chicago subway system.

Tentative plans for illumination provide for a much greater intensity of lighting than has been utilized even in the more modern subways in eastern cities. Intensity of illumination will average 2½ foot candles on the platforms and 4 foot candles in the station mezzanines and stairways. Lighting may be both direct and indirect, and it is planned to arrange the outlets in such a way that advantage can be taken of the new fluorescent type of lighting if it is found to be practical.

How Will the Subways Be Built?

The construction of this $40,000,000 project is the direct responsibility of the newly organized City Department of Subways and Traction—Mr. Philip Harrington, Commissioner. Of the total cost, 45 per cent or $18,000,000 will be borne by the Federal Emergency Administration of Public Works. Under the terms of the grant agreement between the City and Government, all plans and specifications will be approved and the construction carried on under the inspection of the P. W. A. project engineer, Mr. Joshua D'Esposito, and the able commission of engineers appointed by the Administrator to report on the project in behalf of the Government.

The requirement that the project be substantially completed by June 30, 1940, or in a period of eighteen months, involves a high speed program not only in the preparation of plans and specifications by the city's engineering staff but also in the careful planning and high speed execution of work on the part of the contractor. In order that the project shall be completed on time, the work will be subdivided into fairly short contract

sections. There will be six tunnel sections on State Street Subway, Route No. 1, and five tunnel sections on Dearborn Street Subway, Route No. 2—a total of eleven sections, with an average length of 3,220 feet. Each of these contracts will provide for the construction of all of the work to be done in the tunnel, including the wider sections at the station platforms.

It is contemplated that tunneling will be carried on by methods successfully developed by a number of contractors in the construction of large intercepting sewers constructed during the last few years by the Chicago Sanitary District.

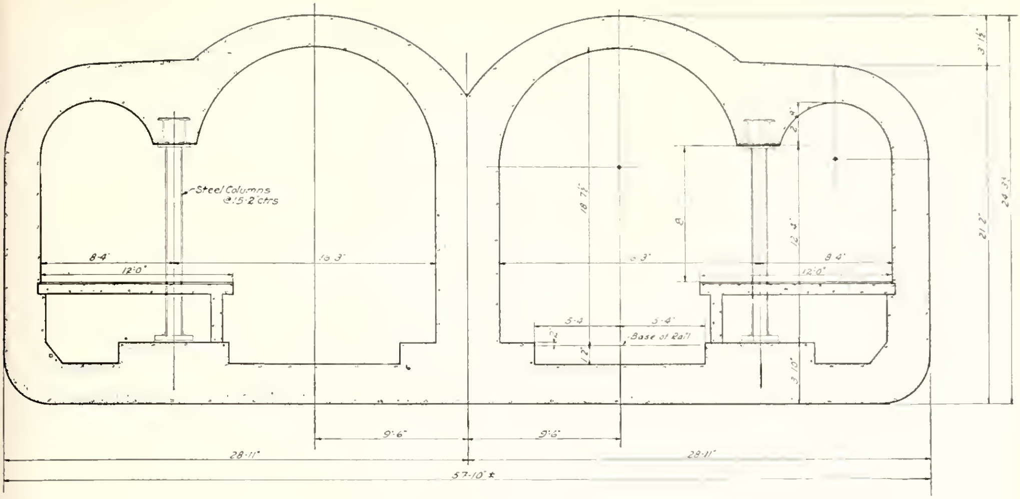
The soil conditions throughout most of the project are well adapted to tunneling methods. The use of three pounds of compressed air is specified, and it is contemplated that the conditions will be such as to warrant the use of seven or eight pounds of pressure. No construction procedure is prescribed in the specifications, but the contractors are required to submit their proposed procedure for approval before construction is begun.

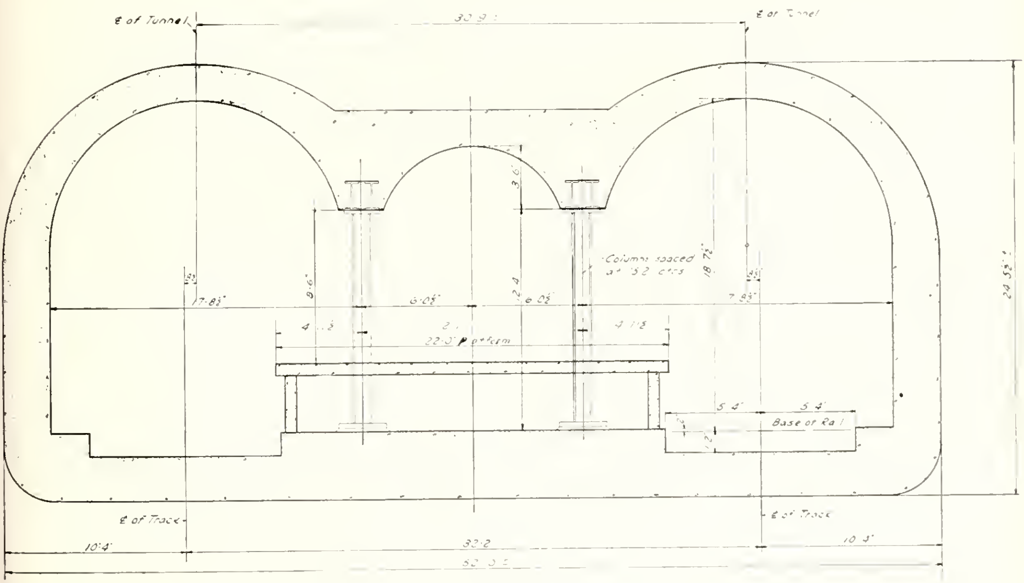
The mezzanine stations, stairways, entrances, and connections will be constructed by cut and cover methods. This construction, involving, as it does, openings 18 feet to 20 feet in depth and, in general, about 60 feet by 80 feet in area, will be made in the methods utilized on work of this character in New York. Pavement and top soil will first be stripped, temporary wooden decking will be laid on steel cross beams and girders, and the work of excavation will then be carried on underneath the temporary decking. Existing underground utilities, except for gas mains, will be supported during the construction period by steel cross beams. Temporary sewers will be required, although in some cases permanently relocated sewers can be built in advance of the station construction.

The station structure proper will be either steel and concrete or reinforced concrete and, in general, will be supported on the tunnels previously built. After the completion of these structures, work will be backfilled, utilities restored to their permanent location, and new pavement constructed over the cut.

How Will Initial Subways Be Used?

The initial subways will provide much needed terminal tracks for the elevated rapid transit system. Inclines to be constructed at the terminals of the subways will provide physical connections for operation of north and south side elevated trains through the State Street Subway, Route No. 1. The Dearborn Street





Upper Left: The contractor's vertical shaft showing the early stages of construction.

Middle: The face of the tunnel, showing the temporary tunnel structure which is pushed forward as the work proceeds. The sub-soil being removed is the clay which will be typical of the remainder of the boring.

Lower Left: Tunnel connecting the vertical shaft with the subway bore to permit the removal of the clay. Tracks of the trucks that carry the clay can be seen leading to the State Street tube, which had just been started at the time of the picture.

Upper Right: Typical section, at a station of an island platform.

Lower Right: Typical section, at a station of a side platform.

This compression plant supplies the compressed air necessary to maintain the required pressure in the various sections of the tunnel.

The completed shaft, showing the hoisting mechanism which will be used to bring the excavated clay to the surface.

Subway, Route No. 2, will accommodate trains from Humboldt Park and Logan Square which will be turned back at a stub terminal on Dearborn Street south of Van Buren Street, pending the construction of the remainder of the west side subway. The operating company will install all equipment necessary to the operation of the subways and in addition will construct the inclines connecting to the elevated structures at the terminals.

How About Utility Structures?

It is a matter of common knowledge that much of the sub-surface space in the streets of the central business district is occupied by a complicated network of underground pipe lines, conduits, manholes, and other public and privately owned utility structures. The general plan of the project, whereby the major portion of the work will be done by tunneling, eliminates most of the problems of maintenance and restoration of utility structures which would be involved in cut and cover construction. While there may be some slight disturbance of structures due to minor settlement of the streets incidental to tunneling operations, it will be so limited as to require no substantial utility maintenance or restoration problem with the possible exception of gas mains and service pipes.

However, at the mezzanine stations, which will be constructed by open cut, it is necessary to develop plans for maintenance during the construction period and for final restoration of these utility structures. We are fortunate in having the wholehearted cooperation of the engineering staffs of the several private companies and city bureaus owning and operating utility structures who have created an engineering committee which is rapidly and efficiently preparing the necessary plans. The cost of supporting and restoring city owned utilities will be included in the subway project, and, while there is as yet no agreement as to who will pay the cost in the case of private utilities, an agreement has been reached on procedure so that the work will be carried on in a manner that will not interfere with or delay the subway construction and without prejudice to the rights either of the private companies or of the city with respect to ultimate determination of who will pay the cost.

The existing freight tunnels now owned by the City of Chicago and operated by the Chicago Tunnel Company will be eliminated on certain of the streets in the downtown district.

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CHEESEMAKING

AN ANCIENT ART
A MODERN SCIENCE

By
James L. Kraft

James Lewis Kraft, President and Founder of the Kraft-Phenix Cheese Corporation.

CHEESEMAKING is one of the oldest manufacturing arts in the world, and one of its newest sciences. That cheese was a familiar food as far back as 3000 B.C. is attested by an interesting archaeological discovery made near the ancient city of Ur a few years ago—a bas-relief which depicts the dairy industry of that early day. Cheesemaking and buttermaking are clearly shown, as is the early Babylonian method of milking a cow. This first of all historical records of dairying was found in a small temple at Al-Ubaid, sacred to the milk goddess of the Babylonians. The original temple discoveries reside in the British Museum. A replica of the dairy bas-relief may be seen by visitors in the new international headquarters building of the Kraft Company here in Chicago.

Babylon, the cradle of so much of civilization may well have been the birthplace also of the ancient industry of cheesemaking. The exact date and place of the production of the first cheese are lost in obscurity. But the approximate method of the early discovery may readily be imagined.

The Greeks believed that cheese was invented by Aristaeus, a demigod, son of Apollo. Scarcely less picturesque and considerably more credible is the legend that the first cheese was produced by accident by a far eastern traveler. The desert merchants of that day were accustomed to carrying milk rations for their journey in skin bottles made from the stomachs of calves. One such traveler, pausing at the end of a long day's ride, took down his canteen preparing to slake his thirst with a draught of cooling milk only to find that a thin watery substance poured from the container. Examining further he discovered that at the bottom of his flask was a mass of semi-solid food, the curd of milk. Only the whey portion had poured from the canteen. Hunger and thirst, and perhaps the true scientific spirit of research tempted that early discoverer to taste the semi-solid substance—the world's first cheese. To his satisfaction he must have found the goat's milk curd a pleasing and delicate food—sufficiently pleasing so that the accidental discovery was worth repeating by intention. The secret of the earliest accidental production of cheese was of course the miraculous natural effect upon milk of rennet, present in all animal stomachs. The traveler had in his haste placed milk in a canteen not quite dried, and in which, therefore rennet was active.

The transmutation of fluid milk into

Bas-relief depicting the dairy industry of the ancient city of Ur, 3000 B. C., which can be seen in the new Kraft Building. The original of the relief is in the British Museum.

solid cheese remains one of the miracles of nature, a miracle nonetheless which man has learned to control, to regulate, to pattern to his tastes. As cheese is one of the oldest of all manufactured foods, so it is one of the most diverse. Cheese is known by thousands of different names in the different countries of the world. France alone lists more than 400 varieties as her special contribution to the art of dining. Most of the world's great cheeses have been named for the particular locality in which they were first produced, or in which they became famous. In one form or another, cheese is known to every people and every nation of the world. Cheese was used by ancient tribes as a medium of exchange, long before coins were acceptable.

Many tiny villages and provinces have achieved world-renown—immortality among gourmets—because of the distinctive cheese types which they have produced. Roquefort, Camembert, Cheddar, Cheshire, Emmenthal are typical examples. A list of the world's cheeses is a pronouncing gazetteer, a gastronomic baedeker which would take the true cheese-lover all around the world, with a special cheese-treat in virtually every place where he might stop. But though the name of cheese is legion, scientific analysis shows that all of the hundreds of members of this large clan belong to eighteen distinct family groups. These are, listed by their most familiar names: Brick, Caciocavallo, Camembert, Cheddar, Cottage, Cream, Edam, Emmenthaler, Gorgonzola, Gouda, Hand, Loaf or process cheese, Limburger, Neufchatel, Parmesan, Pecorino, Romano, Roquefort, Sapsago, and Trappist. Cheeses may be classified also into hard, soft semi-hard, and semi-soft varieties. But each of the many hundreds of different cheeses found in the world, whatever its family associations, has a distinctive flavor and character, and generally a coterie of devoted gourmets all its own.

The legend and history which surround the creation of the world's great cheese varieties are endless. The creator of Camembert was said to have received the benediction of a kiss from Napoleon himself for her cheesemaking prowess. Mme. Harel was her name, and the townspeople of her native village erected a statue in her honor.

Roquefort was said to have been produced first by a wandering shepherd boy who left his lunch of barley bread and cheese in a particular wind swept cave in the Cevennes uplands of France. Returning a few days later, he found his cheese veined with a curious green marbled coloring—the result of the accidental curing which the cheese had undergone in that period of time. The monks of that vicinity thereafter produced Roquefort by intention, and the method of preparing this delicacy was carefully guarded in the monastery from the year 1070 to the time of the French Revolution.

Swiss cheese, with its distinctive "eye" formations and its nut like flavor has a long and distinguished history. It was originated in the Canton Bern, Valley of Emmenthal, Switzerland, many centuries ago. By the middle of the 15th century, the Swiss cheesemaking industry was well established in the Canton of Emmenthal, and by the middle of the 17th century, Emmenthaler Swiss was exported in quantity. Swiss cheese today is manufactured in many countries. A great quantity of Swiss is made in the United States, principally Wisconsin.

Cheddar cheese is perhaps the most familiar of all cheeses in America, since it was the forerunner and prototype of our own American cheese. Cheddar cheese was first produced in the tiny village by that name in Somersetshire, England, several hundred years ago. Although it is one of the most ancient of British cheeses, the distinctive method for producing cheddar cheese is comparatively recent. "Cheddar" is now used as a term to designate a method of manufacture, rather than a particular size or shape of cheese. The distinctive "cheddaring" process was evolved by a dairy farmer in England. It is the "cheddaring" operations at a certain stage in the manufacture of this type of hard cheese which gives it the characteristic smooth consistency which we recognize in our own American cheese.

As cheese is among the oldest of all manufactured foods, so it has been an important staple to peoples of many nations and generations. The Greeks and Romans valued cheese highly as a war-time ration because it represented high energy value in concentrated form. Athletes whose prowess made them renowned in Olympic games from earliest days trained on cheese and fruits. Not only was cheese a favored food for the warriors and athletes of the days of the glory of Greece, but it was also considered proper food for the gods. Offerings of the finest cheeses of the country were made to the gods on special feast days. It is said of that ancient and abstemious philosopher, Socrates, that he permitted himself one indulgence—the savoring of cheese cakes, his favorite food.

No records are available as to the per capita cheese consumption of ancient peoples. But in more modern times, we find that the world's greatest cheese-eaters are the hardy Swiss. Their annual per capita consumption of cheese is 19.2 pounds. The French are next in line, with 16.6 pounds each to their credit. The Dutch consumer 15.4 pounds, the Scandinavians 10.8 pounds, the Danes 10.57 pounds, the British 9.69 pounds, and the Germans 7.01. Although America is the largest producer of cheese in the world, annual per capita consumption in this country is less than that of other cheese-eating countries. Five and a half pounds per person was the record in the United States last year. Although this country lags behind many others in this regard, per capita cheese consumption has grown with remarkable rapidity within the past few years. Last year's figures show cheese consumption double that of two decades ago.

The history of cheesemaking in this country is comparatively brief, but of vital importance to the industry around the world. America's distinctive contribution to the history of cheesemaking is the application of science to an industry which had been for centuries a highly individual and therefore variable art. American research has contributed an important share of the world's knowledge of cheese and its parent product, milk. The cheesemaking industry in this country today presents an impressive picture of the development of a national industry within a few brief years. Today the industry is widespread, with branches throughout the United States. Today virtually every type of cheese known elsewhere in the world is made with outstanding success in this country. Today cheese is a familiar food of increasing importance in American diets, and America leads the world in volume of cheese produced.

Cheesemaking as an industry in this country dates from the middle of the 19th century. Previous to that time, the production of cheese had been an individual dairy farm operation, performed in this new land by men and women reared in the traditions of European countries. With them they brought not only the social traditions and customs of the other world, but also a knowledge of the arts of cheesemaking practised in their several home-lands. The English, and the Dutch settlers of old New York State, homesick even for the familiar tastes of the old country, produced cheese in their own dairies and kitchens for

their own families. Occasionally a particularly skilled cheesemaker would make cheese for his neighbors. But not until 1851, in Rome, New York, was the first factory operation introduced into cheesemaking. That small country plant, set into operation by a dairy farmer named Jesse Williams, was perhaps the first cheesemaking factory in the world, since the industry, ancient as it was in foreign countries, was principally a small individual dairy operation. The factory at Rome, New York, produced American cheese—of the large familiar cart-wheel variety. Cheese made at the Williams' plant attained much more than local fame, and by the 1870's some of it was even exported to England—a genuine triumph for the new industry in America.

Within a few years of the establishment of the factory at Rome, New York, many factories had sprung up in Herkimer County, and Herkimer County American cheese had attained wide fame. Cheesemaking in New York State rapidly became an important industry. The excellence of pasture-land, wealth of milk supply, and

Upper Left: Liquid milk becomes "curd" and "whey." After "starter" and rennet are added, the milk forms into a soft curd, much like "junket." The curd is then cut into small cubes (1/4") by special wire knives. The photograph shows the cutting operation.

Upper Right: "Ditching" to drain off the whey. After heating and stirring, the curd is permitted to settle and the whey is drained off. The curd is drawn to the sides of the vat to permit through draining.

Lower Left: "Cheddaring" for body and texture. When ditching and draining are complete, the curd is cut into large slabs which are piled as shown in the photograph. This operation is called cheddaring and is repeated several times until the desired body is obtained.

Lower Right: When cheddaring is complete (judged by the firmness and texture of the curd) the curd is cut into small pieces in preparation for salting and pressing (for eighteen hours) in cheese cloth lined "hoops" of the desired size and shape.

the knowledge of cheesemaking inherited from many generations of European cheesemakers combined to make the industry thrive. Hundreds of small factories grew up, spread to Ohio, then on into Wisconsin, with the westward movement of population. By 1869 at least 75% of all American cheese was factory made in Wisconsin.

As the Germans, Dutch, Swiss, and English moved westward, carrying their knowledge of cheesemaking with them, the industry continued to grow. American, Swiss, and Limburger factories sprang up in Wisconsin until it became and has remained the nation's leading cheese producing state. Thousands of small cheese producing plants today attest to the greatness of the industry in Wisconsin. Westward, and still westward the industry spread—to Idaho, the Pacific Coast, south to Texas, to Georgia, throughout the United States. Today every section of the United States produces some cheese, the U. S. department of agriculture listing some 200 types.

The wide expansion of the industry

Upper Left: After shredding, the cheese is blended and pasteurized. The photograph shows one of the several pasteurizers in a Kraft blending and pasteurizing plant. It has a capacity of 90,000 pounds daily.

Upper Right: Removing American cheese from the hoops after eighteen hours of pressing. These are the Cheddar size and shape, weighing about sixty pounds each. Other sizes are Daisies, Longhorns, Young Americas, Flats, Prints.

Lower Left: Blending many lots of cheese skilfully is the only method of assuring uniformity. Master cheese blenders test, taste, and blend many cheeses, combine them in exactly the right proportion to attain perfection of flavor, body and texture.

Lower Right: Immediately after pasteurization, these ingenious machines foil, wrap and seal the cheese in air-tight, dust-proof, sanitary packages to protect its purity and freshness. This battery of machines packages over 200,000 half-pound units daily.

of cheesemaking in this country was made possible by the application of science to this venerable art. Cheese, in degree according to its type, is a variable food. The so-called uncured types, of which cottage cheese and cream cheese are examples, are almost as perishable as milk itself. The hard cheeses, exemplified by our American and Swiss, have the highest keeping quality, yet the very curing process which gives these, and all cheeses, their individual flavors, does not stop when the cheese has reached maximum flavor. Bacteria-ripened cheeses, such as Brick, Muenster, and Limburger, and mold-ripened cheeses, like Roquefort and Camenbert, are by their very nature subject to rapid change. They must be carefully controlled, not only in the manufacture and curing process, but must be distributed with equal care to insure their arrival on the consumer's table in prime condition.

For many years cheesemakers had been attempting to produce cheese which would retain its maximum flavor and character, cheese which could be readily marketed without rind or waste. Many attempts had been made both in this country and abroad, none of them successful, until the first process cheese was developed in Chicago in 1909 in the small plant of the Kraft Company. The scientific apparatus used in the production of the first processed cheese was simply

Research worker using the Soxhlet machine for extraction of fat.

Research worker making bacteria counts.

Research worker in the new Kraft laboratories using Kjeldahl apparatus for protein determination.

a copper kettle, in which all of our early experiments were made. The world's first successful packaged cheese was American cheese in tins, a product which was shipped to the allied armies during the World War. Immediately following the War, the first of the packaged cheese types as we know them today—the five pound loaf—American cheese made its appearance, to be followed soon by loaf Swiss cheese.

Five pound loaf cheese was the forerunner of all the process cheese package types which are known today throughout the world. The development of packaged cheese in this country was of far-reaching importance in the growth of the industry, making it possible to provide uniformity and high keeping quality in readily marketable form.

Hand in hand with developments in the production of package cheese have come outstanding advances in scientifically controlled production of all types of cheese, in the utilization of the whey portion of milk previously lost in cheesemaking. Research in the dairy laboratories has also contributed many important chapters to the world's knowledge of milk, the parent product of cheese.

The quality control program maintained by the Kraft Company extends to each of the many hundreds of plants which it maintains throughout this country and the world. Control laboratories are an important feature in each. Center of this control program, and of the company's extensive research program are the laboratories in the Chicago plant, international headquarters of the company. This series of laboratories is particularly interesting from the standpoint of the research worker and the engineer alike because of its completeness and special adaptation to particular problems. Laboratories include a central quality control room; a research laboratory for the solution of special problems and the perfecting and creation of new products; a bacteriological laboratory; a room housing the Kjeldahl process for the determination of protein; a biological laboratory for the maintenance of nutrition studies; a weather room; and extensive store-rooms for the housing of supplies used by the various laboratories.

One of the most interesting fea tures of the laboratories—a uniqu feature in a food manufacturing plan —is a room containing machinery o semi-plant size for experimentatio of all kinds. This doll-house siz equipment offers a practical work room with actual machinery of th type used in manufacturing units, on small scale. Homogenizers, pasteur izers, filter presses, and other regula tion plant equipment are here used t solve problems of cheesemaking an the manufacture of other products The company laboratories are staffe by a large number of trained scientifi workers, each performing a specia function in the research and qualit control programs.

American scientific research ha done much to make cheesemaking a exact science—to improve quality o familiar products and to create ne products. In the light of comparativ time, cheesemaking in this country i young. In the light of developmen it has shown phenomenal growt Few foods are more interesting fro the standpoint of the historian, th nutritionist, the research worker.

International Headquarters Building, Kraft-Phenix Cheese Corporation, Chicago.

MICROFILMING

FOR INDUSTRY AND THE ENGINEER

By

David F. Noll

MICROFILMING may be defined as the art of making on photographic film, miniature reproductions reduced to proportions too small to be read without optical aid. Its principal advantage is that it permits enormous reductions in the space required to preserve records which may be enlarged with suitable optical apparatus when, and only when, the necessity for consultation arises. Because of low film costs and the rapid rate of operation, microfilm equipment is also being widely used in the photography of persons and objects in the gross.

Microfilming goes back almost to the dawn of photography. In the Franco-Prussian War of 1870-71, miniature film copies of newspaper and army orders were made in besieged Paris, attached to the feet of carrier pigeons, and sent to the provinces and army hundreds of miles away.

The progressive Chicago engineering firm, studying today the savings to be effected by sending all copies of drawings and correspondence to its jobs under construction in various parts of the world, is closely related to the ingenious French photographer of two generations ago. The tempo of modern business demands that each day's output of drawings and specifications arrive on the job in the shortest possible time. If the job is in India, this means air mail from Chicago to New York, steamer from New York to London, and then air mail again from London to India. A day's mail may cost twenty dollars for an armful of blue prints. With a microfilm camera and an inexpensive enlarger in India, the armful shrinks to a thimble-full of microfilm with corresponding savings in mailing costs.

Microfilm's obvious advantages have been waiting since 1870 for film with long life and high resolving power and for apparatus which would economically take the picture and then restore it to legible proportions when the occasion for consultation arose.

Identification pictures at the rate of 1600 per loading of film permit photography of an industrial plant's personnel at hitherto unheard of speed and economy. The portable camera facilitates moving to the most convenient locations with a minimum interruption to normal plant operations. Schools are using this camera for similar purposes.

The needs of the motion picture industry supplied the lenses and the film of sufficiently fine grain and high resolving power. The ordinary nitrate base film, however, was not permanent enough and it has been superseded by a film with a cellulose acetate base on which the National Bureau of Standards reports that accelerated ageing tests indicate a life expectancy for microfilm the equal of 100% rag content paper. Further, the optimum conditions for the prolonged life of paper are the same as those required for properly processed microfilm.

Acetate base film is hygroscopic, or in other words its moisture content will conform to the air surrounding it. Although film tends to become brittle if the air contains very little moisture, it will regain moisture rapidly if placed in air of the proper 50% relative humidity. Cardboard boxes, free from dangerous chemicals, will assist in maintaining the film's proper moisture content, and they are to be preferred to tightly sealed metal cans. A pan of water allowed to evaporate in the bottom drawer of a file cabinet, or a few dimes' worth of hygroscopic chemicals will replace the pan of water.

For about ten years banks have been photographing checks with highly specialized cameras which could not be purchased outright and which lacked the versatility of a camera like the Graflex Photorecord, which sells for less than $300.

Late in 1936, the American Library Association's Committee on the Photographic Reproduction of Library Materials laid plans for a microfilm exhibit to be held at the Paris Exposition. During the exhibit it was planned to have American made apparatus at work photographing historically important documents of the French Revolutionary period,—all in full view of visitors. It took courage and capital for the manufacturers of this equipment to risk their first models 3000 miles away from shop rescue. Of the two makes of microfilm cameras finally taken to Paris, the Photorecord was the least pretentious in scope and its price was within the reach of the average library's budget, and the original plans did not call for extensive use of the portable Photorecord. It was felt to be a little light for the heavy volume of work to be done, but it was taken along to show what was available to the scholar or library with limited use for a microfilm camera.

To paraphrase the Scotch poet, however, man's plans have a way of going off on tangents, and it is chronicled that the portable Graflex Photorecord bore the brunt of the exhibit's microfilming. Today the Photorecord is in service in the Vatican Library, the British Museum, and the major libraries of this country. A large motor manufacturer's export department is using it to save air mail costs. Thomas Edison's notebook and other historical data connected with the great inventor have all been microfilmed. Copies of county records and engineering drawings can be put on microfilm where they can be removed from the risks of floods, hurricanes, fires, thefts, and misfiling to which the original records are subjected. A large mid-western oil company uses a Photorecord to keep its eye on lease activities in widely scattered oil fields. A chemical laboratory disseminates pertinent technical abstracts to its branch laboratories by microfilm. A Chicago manufacturer photographed all employees in record breaking time and at material cost hitherto unheard of. The Septembe war scare made London's industrie microfilm-conscious.

Briefly stated, the Photorecor camera is a complete, portable micro film camera using 35 mm film and cap able of making rapidly a series o either 1600 or 800 exposures on 10

Adequate magazine capacity for inexpensive film, and rapid automatic operation of the camera are invaluable to photography with the microscope. By appropriate valving of the air pressure supply, pictures of microscopic action can be made automatically at predetermined intervals in the presence or absence of an attendant. The lights can be made to operate only at the instant of exposure.

t. of film at one loading of the film nagazine. By simply stepping on a oot pedal, the operator automatically rings the lights to their full intenity, advances the film, and actuates he heavy-duty shutter which makes xposures varying from 1/25 of a second to one-and-one-half seconds. Since he operator's hands are free to hange the copy or turn the pages beween exposures, the average producion rate is in the neighborhood of 500 xposures per hour. Under favorable onditions as many as 2000 pictures ave been made in one hour.

The size of the material copied may ary from a postage stamp to a newsaper page. If provision is made to nsure stability and adequate illuminaion of the copy, 40″ x 30″ engineerng drawings may be copied without pproaching the camera's apparent mits.

Accessories such as a book cradle, rackets for semi-permanent installaions, attachments to rotate the camra's axis in any plane, additional ghts, enlarging and other projection quipment are also available. Filters o increase contrast and to eliminate tains may be used. The legibility of harred documents may be restored y the use of infra-red film. If larger lms are wanted, the standard 2¼ x 3¼ cut film magazines or film pack adapters may be used in place of the 35 mm film magazine.

To return the miniature image on microfilm to legible proportions, the user has a choice of a number of methods.

If consultation can take place where access to a micro-film reader is available, there are several satisfactory types of enlarging projectors. One of the simplest designs is the Argus Microfilm Reader which is available at about the cost of a good typewriter. For individual use, the film image is magnified 12 times on a translucent screen; for classroom work, the light beam is thrown directly on a wall screen, and the image can be read easily at greater enlargement ratios.

For the very occasional user, pocket and desk-top magnifying devices have been adopted from the optical viewing equipment commonly used in connection with small transparencies and amateur miniature camera equipment.

If a copy of a microfilmed document must be shown where such viewing devices are not available, any one of a number of types of photographic enlarging equipment may be used to make the print. The Graflex Enlarger or Printer is a compact unit serving as a projector or contact printer. The manufacturers of Rectigraph, Photostat, and other photocopying equipment have built special microfilm enlarger heads to fit on the lens board of their cameras. This apparatus is primarily an enclosed light source which projects a beam of a light through the microfilm image. This image is then projected through a suitable lens and on to the photosensitive paper at the back of the camera. Since no light can enter the camera except through the optical system, and since the paper is cut off and dropped into enclosed developing solutions at the rear of the camera, no dark room is needed for the process. Once the first frame of the microfilm is focused at the desired ratio of magnification, the machine needs no further adjustment except to make an exposure of the desired duration. For the engineering office this means that large files of drawings can be readily duplicated from microfilm rolls at a cost not greatly differing from that of blue prints. All copies will be black on white, more stable chemically, and they can be enlarged to any size convenient for reference purposes.

Since the types of photo-sensitive papers used in most photocopying machines is very rapid and produces high contrast, this type of enlarging ap-

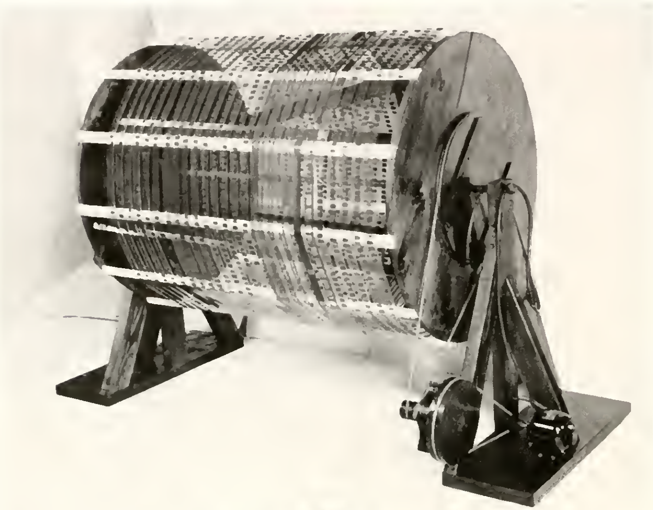
In this portable microfilm picture by Graflex, pressure on the foot pedal does all that is necessary to operate the camera magazine, leaving the operator's hands free to turn the pages which often reaches a rate of over a thousand pictures per hour.

paratus is well suited to the printing of service or reference copies of large sets of records. The microfilm "Master" copy can be filed away in a few safe deposit boxes, where it will be safe from the wear and tear of daily use and from the ordinary risks of loss by flood, fire, hurricanes, theft, or just plain misfiling. The cost of microfilming a typical mortgage book in a county office, for example, is about one cent per page for the film and its processing. A single operator with a microfilm camera can easily photograph the usual 600 page book on one hour's time.

If duplicates of the original microfilm are wanted, positive film prints can be run off on automatic printing and processing equipment similar to that used in the motion picture industry. The individual engineering office, of course, can rarely afford such processing equipment but in most large cities 35 mm film laboratories are available. The cost of the additional film prints is less than one cent per drawing.

Above: This home-made film drying reel will dry about 500 feet of film in half an hour.

Below: Free from gadgets and selling for the price of a good typewriter, this Argus Microfilm Reader will accommodate either 35 mm. or 16 mm. film. Reading for individual use is done on the translucent screen shown here. It can also be used for conference or classroom work by projecting an enlarged image on a wall screen.



One large utility company, for example, is considering the advantages of selected drawings on microfilm for the use of their designing engineers in conference discussions. Every engineer knows the problems created by half a dozen or more men discussing a number of blueprints spread out on an office desk. Drawings are rolled and unrolled many times in the course of a half hour. Not all the conferees can look on from the front of the desk; many have to be satisfied with an upside-down view. Reference to a drawing further down in the pile is time-consuming and clumsy. If some one calls for a drawing, the need for which was not anticipated, everyone must wait until it is produced from the drawing files.

Contrast this with 800 drawings on a four inch roll of microfilm. Any one of the 800 can be thrown on the conference room screen with a few turns of a crank handle and the snapping of a light switch. The image on the wall is comfortably visible to an audience of fifty, if necessary. It is probable that out of 50,000 drawings in a large engineering firm's vaults, a selection of only three or four thousand general plans and assembly drawings will meet all conference requirements.

Enlarged slightly to a size convenient for filing in standard filing cabinet drawers, paper prints of al drawings make a graphic type o drawing index cards. On the plain o unsensitized side of each print may b typed the textual description whic appears on the usual typed or hand written index card. The small pictur on the sensitized side identifies th drawing. Drawings with almost iden tical titles need not be inspected t determine whether the drawing de scribed in the index is the one wanted All details will not be legible but th searcher can tell at a glance whethe the drawing contains the particula section or elevation which distin guishes it from the other drawing with a similar title. Wear and tea involved in examining the origina tracings, the cost of blue-printin copies which later turn out to be th wrong drawing, and the time of th searcher are all reduced by the photo graphic index card.

Whether or not the practice of th individual engineering office or draft ing room will warrant the immediat acquisition of microfilm equipmen every wide-awake engineer will wa to acquaint himself with the possibil ties of the new technique. They wi immediately review their draftin practice to determine whether the siz of legend or weight of line will i terfere with the use of microfilm at later date. Some draftsmen have passion for fine detail and large drav

ings. Reducing a 36" x 24" drawing to the size of a special delivery stamp usually offers no problems for a microfilm camera; but a drawing 60" long can only be successfully microfilmed if the legend and line work was bold enough to register at 30 or 40 to 1 reductions.

From engineering drawings to bulky, hard-to-file papers is a short step. There are large sheets of tabular data, such as generating station logs, statistical compilations, computation sheets, quantity take-off sheets, —all hard-to-file papers which normally create a serious filing problem. Eight hundred or more such sheets can be preserved on a single roll of microfilm.

Recording instrument charts, whether strip or circular in form, tissue thin, or carbon impressions requiring fixative treatment can be filed away on microfilm in a sequence that can never get "out-of-order" at the rate of 7200 circular charts on 4 inch roll of film.

When governmental or other regulations prohibit the destruction of basic records, microfilming them may be even more desirable. Bulky originals may require too much space for expensive downtown office space. Occasional reference to them may be required, however, and may apparently preclude their removal to lower-cost warehouses or record repositories. Microfilm "office copies" may solve this problem. An occasional reference to the microfilm office copy will not affect the originals which can be securely bundled up in never-to-be-disturbed order in the Company's "archives".

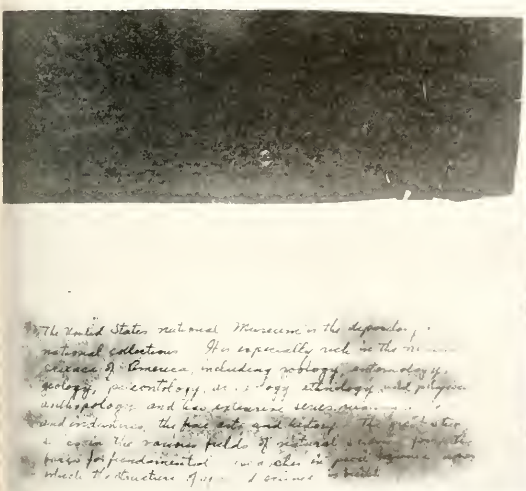
Then there are books of original entry which are costly to replace. They include the field notes of the surveyor and the experimental note books of the laboratory researcher. One large governmental agency reported to the writer that as many as six surveyor's note books were lost each year. The record vault custodian said some were doubtless deliberately destroyed, and others, he felt, were lost to sight simply because "the boys wanted the logarthmic tables at the back of the book." Fire, flood, and hurricane, of course, take their annual toll. The experimental note books of Thomas A. Edison have recently been microfilmed; those of Luther Burbank were destroyed by fire only a few months ago.

But in addition to these rather obvious uses for a camera designed to copy records and reduce them to less than 3% of the space required for the original record, other uses will be found for any camera with adequate magazine capacity for inexpensive film, automatic operation, and fittings which will permit its being used on standard photographic tripods.

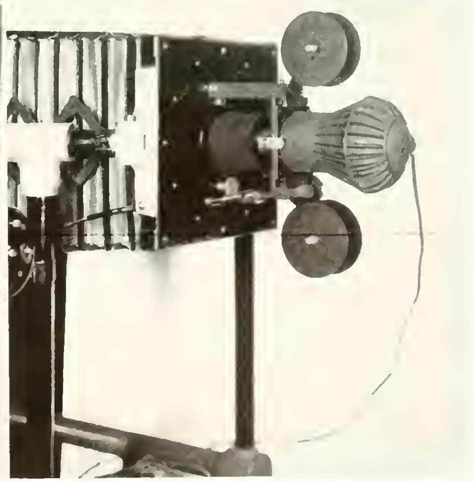
Instrument panels can be photographed at any predetermined interval by suitable valving of the air pressure which actuates the lights and camera. Photography has frequently assisted in making inventories of small parts. A photograph of every pole in a transmission line could be taken in the field at the rate of 1600 pictures per roll of film. The hardware on each pole could be counted in the comfort of an office by examination of the negative in such apparatus as the Argus Reader. Central and sub-station equipment, such as switch panels, could be photographed to provide valuation data which might be hard to derive from original drawings.

The results of tests in research and control laboratories can be economically photographed. Accelerated weathering of paint samples, wearing tests of fabrics, and many others will occur to the reader. A textile mill is interested in microfilming all samples of cloth furnished on its orders as evidence that specifications had been met.

The ingenuity and special problems of industry and the engineer will undoubtedly lead to the utilization of such microfilm equipment as is now being offered in the Graflex Photorecord and probably to a greater extent than in the library field, where microfilm equipment was first used. The principal features to be remembered are (1) inexpensive film, (2) quantity duplicating processes borrowed from the motion picture industry, (3) adequate film magazine capacity and (4) extremely high speed or automatic operation.



The upper photograph of a charred document was made with ordinary film and represents its appearance to the unaided human eye. The lower photograph was made with Infra-red film which renders the original writing of the charred document completely legible.



Microfilm enlargers are now available for attachment to the lens boards of standard Rectigraph, Photostat, and other makes of photocopying cameras. Once the degrees of magnification and focus have been established for the first frame, 800 to 1600 enlargements can be made rapidly from 100 feet of microfilm.

The "Flying Camel" emblem of the Levant Fair in Tel Aviv.

ARCHITECTURE OF NEW PALESTINE

By

David Baker

NOWHERE in the present-day world of uncertainty and distress, is there a country like Palestine. Here is a center of Jewish labor, of flourishing trade and industry, of modern building and progressive culture.

This remarkable development in the economic structure of the country was brought about by the initiative and skill of the Jewish immigrants. An increase in the number of factories and workshops, and in the commodities manufactured, was necessitated by the demand of a growing community for such essentials as cement, bricks, and electricity. Construction work and its allied industries became one of the basic sources of livelihood of the new cities of Tel Aviv, Haifa, and Jerusalem.

This general condition in Palestine has been fostered by the chaotic economic and political conditions of the post war world, and it has been controlled and directed by Jewish idealists of great ability. Already new aesthetic potentialities have been developed, forms that are in themselves sensitive, vital, and inspiring.

To understand these forms fully, to appreciate their possibilities for the future, the geology of the land must be considered in view of the problems which confront the builders of today.

This land west of the Jordan is divided into three parallel zones consisting of the maritime plain, the mountain ranges, and the valleys. Three valleys, partly terraced for irrigation, are located within the maritime sections. The terraces are a severe contrast to the adjacent undeveloped areas. The Haifa acreage, with its marvelous harbor, is being improved industrially. In connection with this industrial expansion are small homes and farms. The wonderful Mediterranean climate prevails throughout.

The Jordan valley forms a second zone with a sub-tropical climate. The valley is the lowest section of land in the world, being below sea level. Because of the intense heat in the vicinity of the Dead Sea, a projecting cornice for buildings is being evolved. This silhouettes shade areas over the window setbacks.

The mountain ranges extend the length of the country. The invigorating climate of this locality offers excellent opportunities for the development of health resorts. Safed, the white walled capital of Upper Galillee, is a part of such a development.

The movement to reclaim mountains and sand dunes by the planting of trees is progressing rapidly. New villages founded on waste lands have been surrounded by foliage. This method beautifies the outlying country and gives the new settlements necessary protection against the elements.

Haifa

In 1925 a strip of malaria-infested land was purchased by the Jewish National Fund and the Palestine Economic Corporation of New York in the vicinity of Haifa Bay. This section extends from Acco to Haifa on the Mediterranean coast. The town planner, Professor Patrick Abercombie of Liverpool University, has divided the land into three main areas.

Near Haifa proper is the industrial zone, which comprises one-third of the stretch of land. This is, in turn, sub-

Left: Apartment House in Tel Aviv. This structure clearly accentuates the balcony. Throughout the city, the balcony design varies from the simple steel-tube projections to the more complicated arrangements of concrete and glass.

Below: Apartment House in Tel Aviv, Z. Rechter, Architect. The modern work of Europe is reflected by this dwelling. A part of the building is raised on stilts in the manner of the French architect, Le Corbusier. This provides additional ground space for use as a combined terrace and garden. The window projections lend interest to an otherwise plain fecade, and provide a shelf on the interior. Low and long windows solve the problem of sunlight and air. Similar window treatments can be found among the better modern buildings in Tel Aviv.

divided into areas for heavy and light industrial plants. The second area is the residential zone. Beyond the residential zone is agricultural land from which farm produce for the districts will come. A green strip between the industrial and residential areas is included in the program of works. It is a park more than a mile wide which serves to keep the influence of industry from the home suburb. The entire layout of housing, from the building regulations to the style of architecture, is in charge of Alexander Klein, who has previously worked in both Russia and Germany.

The recent German-Jewish infiltration has given impetus to the industrial growth of Haifa. New markets have been opened in Iraq and Russia. The British government has constructed a central aerodrome in the heart of Jewish National Fund land in conjunction with the harbor development.

New methods of construction have evolved as the result of the timber shortage. Structural terra cotta is being used on an increased scale. Bitumen forms for concrete foundations and buildings is one of the most notable inventions of the new age. Cement factories have expanded, and the demand has called for the addition of a new plant as well as for the operation of several labor shifts during the night and day.

The Hebrew Institute of Technology at Haifa, known as the *Technicum*, has been established in response to the demand for skilled architects and engineers. The architecture of the *Technicum* conveys large Byzantine forms exemplified by modern construction, good fenestration, and symmetrical planning.

The Shemen oil factory is an isolated unit built of stone and concrete. It is one of the first attempts to solve logically the problem of proper light and ventilation of buildings in the Near East. The Haifa hydroelectric plant, built by Erich Mendelsohn, presents a building well studied in relation to its function and the accompanying waste lands. It is a simple, massive, and well-proportioned structure.

A plan for the layout of Haifa was considered before private exploitation of the land took place. Fortunately, it is being developed according to the best principles of city planning. Today, Haifa is the commercial center of Palestine. It is the meeting place of East and West.

Tel Aviv

Thirty years ago several Jews from Jaffa borrowed $60,000 to purchase a

Above: Headquarters for the Jewish Agency and Zionist Organization, Eugene Rattner, Architect. Below: A view of the new Ruttenberg Power Station for Haifa.

strip of beach on the Mediterranean Sea. There followed a slow emigration out of miserable Jaffa to Tel Aviv, or "Spring Hill". The bungalow suburb began to grow. In the year 1909 it boasted seventy houses built upon sand foundations. At the outbreak of the Great War, two hundred houses dotted "Spring Hill". The area occupied by the city increased from 0.04 of a square mile to 2.75 square miles. The number of homes reached a total of 4,029. Four thousand trees flanked the streets where none had formerly stood. Today, the city of Tel Aviv reflects the architectural forms which are typical of both Berlin and Bagdad.

The city architect laments that "The place is built without any plan whatever—street here and street there, just as the caprice or profit of the landowner dictated. No Michigan Avenue, no unity, no distinction." The same is true of houses. Each man built to suit himself. If he had plenty of money, he erected a lofty building; if he had little, a single story structure. One householder rejoices in an imitation oriental palace with four floors and a flat deck, the next door neighbor in his medieval castle of Wilhelmenie Gothic with its red tile roof.

However, Dr. von Weizl does not consider it a tragedy. He is undoubtedly impressed by the vitality of the place. "The architecture is as bad as parts of modern Berlin. It did not wait for the Zionist executive to draw plans. It has not delayed until eminent architects designed ultra-modern houses no doors—invisible windows to line streets. It sprang up of itself—no financial nursing—no fussy interference of outsiders. It is admittedly irregular. There is one consolation, however; cities built by wise Palestinian officials may be beautiful, but they refuse to grow." No other town has prospered as has Tel Aviv!

The typical street intersection at the present time is irregular. Several of the thoroughfares are wide enough for four-lane vehicular traffic. Awnings are commonplace on shop fronts, and are used as advertising mediums, Hebraic and English signs being printed upon them. There is a general fondness for balconies. Balcony arrangements, due to climatic factors and to the penchant of the population for celebrations, are destined to personify the architecture of the future.

Above: Elementary School, Degania, Richard Kauffman, Architect. This building is situated in the sub-tropical Jordan River Valley. The structure is of brick and reinforced concrete. The lofted roof, framed with wood and covered with asbestos sheets, provides circulation of air and gives protection from the sun.

Below: An air view of Nahalal. This cooperative settlement is typical of the "European Plan."

The Rothschild-Hadassah-University Hospital and Medical School, Erich Mendelsohn, Architect.

In accordance with its vast building program, the city has sponsored the Levant Fair. It occupied 0.01 of a square mile in 1929, and 0.05 of a square mile in 1934, and has since been built upon a permanent basis. The area consists of low-lying sand dunes over ten feet above the mean sea level at the entrance, and slopes to six feet above sea level at the farthest point. The site is northwest of the city, the Mediterranean bordering its west, and the river Yarkon its east. There is the intense beauty of the sea, and a magnificent fertile plain north of the river.

The plan adopted for the Fair was one that offered the most pleasing variety. Buildings are grouped about public squares or open spaces. The main features include local and foreign exhibits.

The entrance to the Fair is marked by white metal columns twenty feet high, and surmounted by the "Flying Camel" emblem. Indirect lighting emphasizes the architectural features and creates the traditional oriental night atmosphere.

The building aspects present large unbroken surfaces. The color is quiet in spite of the demands imposed by such a layout. Light colors are evident, with darker tones at the bases. The British pavilion is a fine example of broken white. The window recesses are red, and the base is a dark blue. A light, airy, and inspiring architecture appears to be in the process of creation.

Originally, in Tel Aviv proper, 60 per cent of each lot was devoted to garden area. However, under the intense immigration pressure, certain garden areas had to be used for housing purposes. Tenement structures have also been built to cope with the new problem. These new buildings open out to the landscape, admitting the sea wind from the west by day and the east wind during the night. The influence of the modern work of Europe has been transplanted from Tel Aviv to the interior city of Jerusalem.

Jerusalem

Rahavia, the largest Jewish suburb of Jerusalem, shows tendencies of a new architecture. The buildings are of simple native stone with plain facades. The window setbacks are larger than ordinary, and there is no wood trim about them. They have, of course, the tile floors typical of the Near East home, but they do not have the usual dome.

It is the new city of Jerusalem which is almost totally independent of that section within the old city walls that is playing an important and noticeable part in the cultural and progressive life of the city. The Hebrew University, built upon Mount Scopus, is finely proportioned in traditional Byzantine forms. The ma-

Left: Lower photo shows the three units of the Rothschild Medical Center: a 300 bed hospital in the foreground; a nurses training school and residence, rear center; and a post-graduate school of medicine to the right. The buildings are planned according to the best American standards for hospital equipment and layout.
At the top is a close up of the front facade during the early stages of construction.
Middle photo illustrates the double window treatment which has been designed to provide protection against the winds.

Below: The Assutah Private Hospital, Tel Aviv, Joseph Neufeld, Architect. This hospital was built to serve the rapidly growing town of Tel Aviv. Ample land allowed complete freedom in plan. The elevations are simple and attractive.

terials are native to the vicinity, stone and stucco. Adjacent to the University is a large hospital built by Erich Mendelsohn. The structure is well balanced, and powerful in its horizontals, a dramatic conception beautifully adapted to the site.

Eugene Rattner's building for the Zionist headquarters is a large blocklike structure with narrow fenestration and smacks in character of a stilted Egyptian archaeological effort.

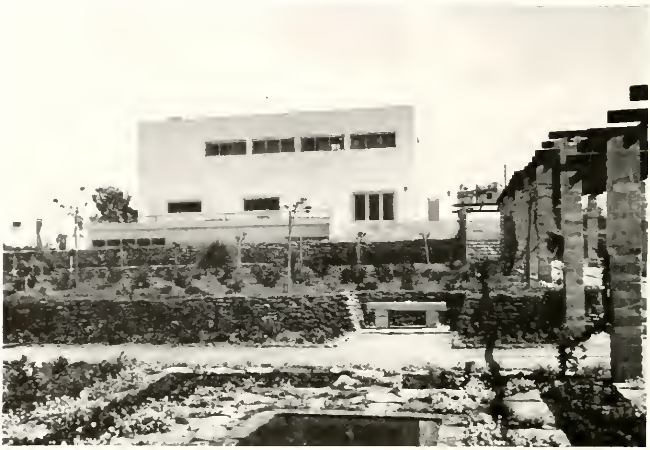
The new city boasts of a motion picture theater which is the counterpart of those in smaller European capitals, both in architecture and equipment. There are paved streets, plus a new million dollar Y.M.C.A. Cafes, modeled upon those of continental Europe, have taken root in the life of the capital. Archaeological schools, representing all of the leading countries, have been established.

The newest addition is the Rockefeller, Jr. Archaeological Museum, which is built outside the east end of the north wall of old Jerusalem and is surrounded by the Valley of Jehoshophat and Mount Scopus. The building is a splendid architectural example, more or less American in plan. It consists of a central mass flanked by two wings about rectangular courts. The central entrance hall has eight windows in an internal dome that is supported by squinches. Flanking the dome at a lower level are barrel vaults which are revealed externally. The building is vaulted in the traditional manner. Where there are flat ceilings, the roofs are of reinforced concrete. Bronze grilles and sash treat the window openings, or "reveals". The exhibition area has arched openings and cloisters for fragments. The doors are of Anatolian or Syrian walnut. The floors are of cork tiles with a skirting of black terrazzo, and the walls are simply plastered. The surrounding cypress trees challenge the emptiness of the outlying desert. On the whole, the building casts a beautiful array of white simple masses against the quaint old city.

Le Nouvel Hôtel consulaire is a notable foreign influence that must be considered. The structure is beauti-

Above: House in Ramath Gan, Joseph Neufeld, Architect. There is a similarity between the residential work of New Palestine and that of Germany.

Below: Workers' Club in Tel Aviv, Arjeh Sharon, Architect. The structural system of this building made possible a spacious dining room on the ground floor. The interior bays formed by this system provide attractive nooks for dining and study.



fully designed. A veranda and salons surround a well-planned garden. A mirror of water and a splendid pergola face the veranda. Indirect lighting beautifies the interior and sparkles betwixt terra cotta *objets d'art.*

Today, as in the past, Jerusalem is the great city of foreign culture. It is the natural center of the Jewish national resettlement. Moreover, it is the village wherein the vast energy, the will power, and the achievements of the Jewish immigrant have taken on new life and color.

Villages

Approximately one hundred and twenty villages have been established in addition to the three famous cities of this region. The coastal plain has fifty-one colonies, the suburbs of Jerusalem have eight, the Emek has thirty-one, Lower Galilee has eighteen, and Upper Galilee has nine. The entire village area covers 300,000 acres.

Raanana, the most progressive American colony, was created for the purpose of encouraging and facilitating private initiative in Palestine. It has developed what is known as the "American Plan." Every colonist has his dwelling in the midst of his own orange grove. Residence is permanent, and the houses are well shaded by trees which are scattered over the surrounding plain. The colony center has its public buildings with the required stores and shops. The "American Plan" has many advantages. It brings the colonist into a more intimate contact with his plantation, it facilitates his work and observation, and it makes the younger generation more soil conscious and more expert in agricultural work. However, the colonists are more in sympathy with the "European Plan", which provides for the centrally located village wherein the settlers dwell. The fields and other land allotments are thrown out in a circle adjacent to the village.

The majority of these settlements are developed along lines of cooperative endeavor. They have no practical counterpart in present-day society, for they are free from established European influence, and influenced only by Jewish tradition. The result has been the development of a new approach in many fields, particularly that of architecture.

Eventually it seems possible that this new approach in art and building may lead to the discovery of plastic materials for a more direct expression of that modern and progressive culture which is in keeping with the spirit of the new Palestine.

Above: The Levant Fair is a permanent trade fair sponsored by the city of Tel Aviv. The relationship between the pavilions and the open spaces are pleasant. The main features include local and foreign exhibits.

Below: Cafe in Tel Aviv, Joseph Neufeld and Joseph Jarost, Architects. The cafe proper is two stories in height and is unsymmetrical in plan. The character is well defined by the openness of the interior layout and the simplicity of the facade.

SUGARING IN VERMONT

By

E. M. Root

Horse-drawn sledges haul the tubs of sap over the snow to the sugar house where the ninety percent of water is boiled away to produce a luscious maple syrup.

THE production of maple syrup and maple sugar is strictly an American industry, the United States and Canada being the only countries where these products are made. Vermont is located pretty well in the center of the maple producing area, and for years it has held undisputed supremacy both as to the amount and the quality of production. Vermont boys look forward to the maple sugar season much as boys in Georgia look forward to cane-grinding time. The season is always accompanied by maple sugar parties at which maple sugar on snow is the main attraction.

Early white settlers in New England followed about the same methods of making maple sugar as were being used by the Indians. Wooden spouts were substituted for bark and reed spouts, and copper or iron kettles replaced wooden ones. Early production by crude methods and with crude equipment was necessarily slow, and the product made was largely consumed at home. Among the early settlers white sugar was a luxury, whereas maple furnished the sugar for all purposes in the home. It was very fortunate for the early settlers that a sugar supply was found in New England, because transportation was a tremendous problem, and money with which to buy was a still greater one.

The sugar maple (*acer Saccharum*) is, to me, the most beautiful and stately of all trees. The size of its leaves, its broad spread of branches, its symmetry of form, and its clean sleek look make it the number one shade tree wherever it can be grown. The black maple (*acer Saccharum nigrum*) and the red maple (*acer rubrum*) are also used for sugar production. The black maple is not common. Its sap, however, is sweeter than that of the sugar maple and is equal in quality. The red maple will produce sap earlier, and probably as much as the sugar maple, but the color and flavor of the syrup and sugar are not so good. The reason for this is that it is more subject to disease, the color of the bark is red, and buds start earlier in the spring. There are seventy varieties of maples listed, but Vermont produces only seven.

Maple sugar production has declined since 1860 in every state of the Union. This is due largely to the high value of the sugar maple as a timber tree. Production in Vermont has likewise declined, but not to so great a degree as in other states. In 1938, Vermont produced *one-half* of the entire maple crop of the United States. Normally, Vermont produces about 35 to 40 percent of the national crop. The next most important maple producing states are New York, Ohio, and Pennsylvania.

Approximately one-third of Vermont's 29,000 farmers make maple syrup and sugar, and their annual income from the crop is two and a half to three million dollars. The sale of maple trees for timber has cut off an annual income on many farms and in some cases has made it unprofitable to continue the operation of them.

There seems to be a definite tendency for maple syrup to become stronger in flavor the farther north

Above: A familiar scene in a Vermont sugar-orchard in early spring.
Below: Notice the old-fashioned way of carrying wooden buckets on a neck-yoke and boiling the sap in a kettle over an open fire.

the region in which it is made. Why this should be, no one can say; but whatever the cause, it leaves Vermont in a happy medium. Her syrup carries the distinctive maple flavor, but it is mild and delicate, neither flat, like some of that from more southerly regions, nor strong like that from northeastern Quebec. The best, the most delicately flavored syrups, come from this state and from adjoining regions of northern New York and the Canadian townships just north of the Vermont border. Just what maple flavor is, no one can tell us. The chemists will give us the composition in terms of calcium, iron, magnesia, sugar, and vegetable acids, but they fail to locate flavor chemically. The best maple flavor may be described as a delicate volatile bouquet. The odor while such syrup is boiling is most pleasant.

Probably it is not necessary to say that syrup and sugar are made by boiling the sap of the maple tree. The amount of sap necessary to make a gallon of syrup varies from year to year, but it usually takes about 30 gallons. Sap is largely water, about 95%, with from two to six percent sugar. The amount of sugar in the sap is determined by the amount of starch the leaves of the tree are able to store during the previous summer. If the previous summer has been a good one for leaf development, with plenty of sunshine, sap will contain more sugar. Cold weather is essential in changing the starches to sugar.

Just when the sugar season will begin is always a question. A history of Myron Dutton's sugar place in Dummerston, Vermont, since 1860 shows that sugaring started on March 4, in 1880, and on April 2, in 1869. The average has been about March 20. The season varies in length from two weeks to five weeks. It begins as winter is breaking up, with the first warm days of spring, and ends when leaf buds begin to swell. Warm days and cold nights determine how much sugar will be made.

The sugar season is marked by "runs." Freezing nights and warm days with just the right wind are necessary. If the weather continues warm, if it is too cold, if the wind is wrong, sap will not run. Six good sap days are sufficient to make a good maple sugar year, but it usually takes about four weeks to get all of these conditions just right. The amount of snow at the beginning of the season or the depth of frost may not be important. Sometimes the weather will change from winter to continued warm weather. This causes buds to start early, and then sugaring is over. Buds transmit a bud flavor to syrup that is strong and not pleasant.

With the starting of the maple sugar season, buckets are given a thorough washing and scalding. These are usually made of tin or galvanized iron, but there are still quite a lot of wooden buckets in use. They hold from 12 to 16 quarts each. These are scattered in the sugar orchard where the maples are to be tapped. Next comes the tapping. A common bit and bit stock is used, and a hole 3/8 inch in diameter and an inch and a half deep is bored into the tree

Above: In a few orchards a more complicated system of pipes carries the sap to the sugar-house.

Below: A close up view showing the men emptying the sap-filled buckets into the gathering tub.

These tap-holes are about three feet from the ground and are usually placed on the south or east side. They are slanted slightly upward, a metal spout is driven into the hole, and we are now ready to catch the first run. Most sugar makers do not tap a tree under ten inches in diameter. A fifteen inch tree will have two spouts and two buckets. As many as five buckets are hung on the largest maples. Metal covers are fitted over the buckets to keep out rain, bark, and snow. By the time the last buckets are hung, if the weather is favorable, the first buckets will be full of sap. Metal tubs mounted on drays or scoots are used to haul the sap to a central point for condensing. Sap is gathered from each bucket as often as possible to keep it fresh. The gathering tubs usually hold five or six barrels each. The manufacturing plant or "sugar house" is a loosely constructed building with a good roof to keep out rain. It is set so that the sled-loads of sap can be drawn near it on a higher level. This allows for gravity unloading of sap into large storage tanks. Inside the sugar house is a large evaporator. These average four feet wide and fourteen feet long. Wood is used entirely as fuel in reducing sap to syrup and sugar. Some days these large boiling rigs will consume three cords of four foot wood. Speed in boiling is a big factor in producing high quality products, first, because the sweet sap may sour if allowed to stand and, second, because slow boiling keeps the product in the pan too long and caramelizes the sugar. This caramel flavor overshadows the delicate maple and reduces the quality. Modern evaporators are designed so that sap is kept moving from the front to the back of the evaporator and into syrup as quickly as possible. Speed is essential to keep the fresh sap moving from the tree and through the evaporator in order to get the best quality. Thermometers and hydrometers are used to test the density of syrup which, by law, must weigh eleven pounds to the gallon. During the final stages of evaporation some lime precipitates, and it is necessary to filter the syrup through felt in order to remove this precipitate. Settling cans are also used to eliminate the lime.

Many sugar makers have regular customers for their entire crop and so put up the product, as it is made in containers to suit this trade. It is shipped all over the United States. Some sugar makers sell their entire output to wholesalers. When this is done syrup is put into drums holding from 20 to 50 gallons each. The sugar maker who sells direct to regular customers has quite an advantage over those who make for the wholesale trade only. Special rates have recently been made on maple products by the Railway Express Agency. This has helped greatly in marketing the crop in small quantities to distant customers. If the product is to be sold direct, it is canned hot from the evaporator. This guarantees the keeping quality. Vermont is the best market for maple products since nearly everyone who is familiar with the fla-

Above: An inside view of the sugar-house showing the evaporator in full operation. A roaring wood fire is burning in the front part of the arch, and the heat travels back some ten or twelve feet under the pan to the chimney.

Below: At the end of the season wholesalers buy up much of the syrup in fifty gallon drums.

vor of good maple syrup is a customer for life. Regardless of price, a home supply is always kept by the sugar maker.

Many people think of Vermont sugar making in terms of iron kettles and oxen, but Vermont sugar makers have passed that stage. Probably in no area will more modern equipment be found for sugar making. High labor costs have forced efficiency in this field as in many others. Last year a reporter for a large city paper tried to locate a typical sugar orchard with oxen, etc., but he could not find one.

One might think that the taking of from five to forty gallons of sap or from one to ten pounds of sugar each year would be harmful to the tree. But trees showing the marks of 150 years of sugaring are still standing in some of our orchards and are in good condition considering their age. The greatest threat to maple sugar production seems to be the heavy demand for wood heels for ladies' shoes, maple furniture, etc. Low income from other farm enterprises has forced a good many farmers to turn the maple orchard into quick cash with the resulting loss of an annual income from sugar products. Some farmers sensing the bright outlook for maple sugar products are weeding out second growth stands of hard wood in order to favor the growth of sugar maples. Large areas of volunteer seedling maples can by this method be put into production within twenty years. Planting maple trees for sugar production has never been done to any extent and is probably not warranted except in a few cases.

"Sugaring Off" parties are still a part of the sugar season in spite of the fact that most of the maple product is put up as syrup. It was an old custom to invite in the neighbors at least once a year for a "sugaring off." Everyone brings things to eat. The sugar maker as his part, supplies the sugar. Sometimes he broils home-cured ham over the coals in the evaporator and cooks potatoes in the ashes under the large firebox. Coffee is made from partly reduced sap, and eggs are boiled in sap. Maple sugar on snow is the dessert. This is cooked to about the hardness of cake frosting and poured boiling hot on the fresh snow. It forms a wax and is eaten directly from the snow. There is so much fun at these out-of door parties that they are bound to continue. The average consumption of sugar at these gatherings is a pound per person.

Packages for maple products, like packages for other foods, have changed radically in the last twenty years. Gallon cans were once the principal package used for syrup, but now the product can be bought in quarts, pints, and half pints. Glass containers are popular in stores and at roadside stands because the customer is able to see the color of the product he is buying. Fancy packages of maple candy, maple cream, and maple sugar are also increasing in popularity. Increasing tourist traffic has helped a great deal in extending the market area for this *Number One Sweet.*

The New England States have strict standards which assure the buying public of a clean, unadulterated product.

Nature's laboratory: A maple tree in full leaf, preparing sap for the following spring.

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WE PRESENT OUR NEW TRUSTEES

Frank A. Hecht, Jr.

WITH a seemingly inexhaustible capacity for service, MR. FRANK A. HECHT, JR., since his retirement from active business, has devoted himself with undiminished zeal to the causes of civic benefaction.

Mr. Hecht, born July 29, 1888, in Chicago, received his preliminary education in the Morgan Park Academy, and his Bachelor of Arts degree from the University of Wisconsin. He was an active member of the Delta Tau Delta fraternity.

Upon graduation from Wisconsin, Mr. Hecht entered the business of Kaestner & Hecht Co., manufacturers of electric elevators. In 1917 he acquired full control of the company, which had been established by his grandfather, and served his company as President and General Manager until 1926 when he sold it to the Westinghouse Corporation.

Since 1926, Mr. Hecht has lived in Barrington, Ill., where he has been active in community affairs. He has served on the School Board, Chamber of Commerce, and on a Civic League, which he organized. He has also taken active interest in church, Boy Scout, and general community activities.

Mr. Hecht was appointed a Deputy Administrator of the NRA and acted for the government as Chairman of a special committee to fix prices for the Retail Solid Fuel Industry. In addition, he has been closely allied with public affairs in Chicago as President of the West Central Association, Director of the Metropolitan Housing Council, Association of Commerce, and Chairman of the recently organized Citizens Committee that went to Washington in behalf of the Chicago Subway System.

Mr. Hecht was married in 1917 to Margaret Elizabeth Lipps, of Baltimore, Md. They have one daughter, Margaret Elizabeth, who is a student at the University of Chicago. At present, Mr. Hecht is President of the Barrington Countryside Association.

Sydney G. McAllister

FEW men have so ably met opportunity with ability and initiative, and few men may boast so consistent a record of achievement in the world of business and industry as SYDNEY G. McALLISTER, who has literally risen from the ranks to the presidency of the International Harvester Company.

Mr. McAllister was born in Chicago on February 3, 1879, but spent his early boyhood on a farm in central Minnesota. At the age of ten he returned with his family to Chicago and here received his formal education, graduating in 1897 from Chicago English High and the Manual Training School, now known as Crane Technical High School. Upon graduation, he entered the employ of the old McCormick Harvesting Machine Company as office boy at the McCormick works. In less than a year he became timekeeper, the first of a series of steady promotions.

The International Harvester Company was formed in 1902, and in the following year Mr. McAllister was appointed Assistant Works Superintendent of the Hamilton, Ontario branch. In 1908 he was transferred to the plant at Auburn, New York where, three years later, he became Works Superintendent.

At the beginning of the World War in 1914, he was transferred to the Company's European operation, and during the troubled period that followed he held the position of Assistant Inspector General of Manufacturing. His work, involving the supervision of the company's factories in German as well as Allied territory, took him back and forth through the opposing lines on numerous occasions.

Mr. McAllister's record during the chaotic war period earned still greater laurels for him, and, in 1919, he became Inspector General of Manufacturing for the company's European factories, a position carrying with it the complete responsibility for the productive facilities of the company on the continent. Early in 1925, while still holding his position as Inspector General of Manufacturing, he was named Chairman of the Brussels Conference, the centralized European operating council of the International Harvester Co.

In 1931, Mr. McAllister was re

Frank A. Hecht, Jr.

Sydney G. McAllister

General R. E. Wood

called to the United States and appointed a Vice President of the company in charge of the departments of engineering, traffic, fiber, and patents. In 1932, he was again transferred and given the supervision of the manufacturing and engineering departments.

On May 4, 1934, Mr. McAllister was elected First Vice President of the company and that same year was named a director and appointed a member of the Executive Committee of the Board of Directors. Succeeding Mr. A. E. McKinstry, he became President of the International Harvester Company on April 25, 1935. In January of 1938 he was elected a director of the Harris Trust and Savings Bank of Chicago.

General R. E. Wood

THE career of GENERAL R. E. WOOD, chairman of Sears' board of directors, is distinguished by the execution of big jobs, both in the United States Army and in the business and industrial world.

General Wood was born in Kansas City, Mo., on June 13, 1879. After the usual preliminary education he entered the United States Military Academy at West Point and graduated in 1900. Immediately after acquiring his second lieutenant's commission he was assigned to the Third Cavalry regiment and spent the next two years in the Philippines pursuing Aguinaldo's insurrectos. Then followed an uneventful year at Fort Assinniboine, Montana, and a two year stay at West Point where he taught foreign languages to the cadets.

In 1905 he was ordered to the Panama canal zone, where for 10 years, General Goethals had him carry out many important assignments in connection with the construction of the "big ditch". His most important post during this period was that of Chief Quartermaster, a job which involved the hiring of thousands of men, the ordering and distribution of millions of dollars worth of supplies, and the supervision of all building construction in the zone area. For two years he was director of the Panama Railroad and Steamship Line.

In May 1915, General Wood resigned from the army with the rank of major. He then became Assistant to the Vice-President of the E. I. DuPont de Nemours Company, a position which he gave up in a few months' time to take charge of the United States, Venezuela, and Trinidad operations of the General Asphalt Company. However, when Congress declared war in 1917, he immediately offered his services to the War department. His offer was promptly accepted, and he was put to work organizing the purchasing department of the Emergency Fleet Corporation. When this task was completed he was appointed Colonel of Infantry and sent overseas with the Rainbow Division. On his arrival in France he was made a member of the General Staff and placed in charge of the Army transport service.

After the War department had established a centralized set-up for the buying and distribution of army supplies, General Wood was ordered home from France to assume the duties of Acting Quartermaster General. At the same time he was commissioned Brigadier General.

General Wood returned to civil life in March, 1919 after having been awarded a distinguished service medal by the United States government and the C. M. G. by the British government. For the next four years he was General Merchandise Manager and Vice President of Montgomery Ward and Co. In November, 1924 he joined Sears, Roebuck and Co. as Vice President in charge of all retail store and factory operations. Following the death of Mr. Charles M. Kittle in January, 1928, he was elected to the presidency of the company. Upon the retirement of Lessing J. Rosenwald in January of this year, General Wood became Board Chairman.

General Wood is a director of the Illinois Central Railway, the United Fruit Company, the Interlake Iron Corporation, and the National Life Insurance Company. He is a representative of the public on the Board of Governors of the New York Stock Exchange and Deputy Chairman of the Federal Reserve Bank of Chicago.

ARMOUR SPONSORS SECOND MIDWEST POWER CONFERENCE

THE second annual Midwest Power Conference sponsored by Armour Institute of Technology will be held April 5, 6, and 7, at the Palmer House, Chicago. In cooperation with the Institute, seven other colleges and universities, having taken cognizance of the possibilities for public service, have accepted responsibility for the success of the conference. These educational institutions are Iowa State College, Purdue University, University of Illinois, State University of Iowa, University of Michigan, Michigan State College, and University of Wisconsin.

"Only at a centralized conference such as this," said Dr. L. R. Grinter, Director of the Conference, "can all of the technical and social phases of power production, distribution, and utilization be discussed." The program planned is completely comprehensive in scope, covering, as it does, some twenty five topics of industrial and academic import in the various areas of power investigation. Particular emphasis will be placed on steam, diesel, electric, and hydraulic power, with special papers presented on the results of modern practice and inquiry. The results of laboratory researches as outlined by L. W. Wallace of the Crane Co., will form the basis for the hypothecation of new spheres of industrial and commercial applications and methods.

Papers on the design and application of small power plants will be presented by Mr. F. Elwell, of the Buick Motor Division of General Motors, and Mr. G. A. Gaffert, of Sargent and Lundy, and considerable time will be spent in free discussion of the many problems encountered in this field. Electric power generation, transmission, and distribution will be discussed in papers read by Mr. H. Halpern of Commonwealth Edison, Chicago, and Mr. G. G. Post, of the Wisconsin Electric Power Co.; and a pertinent analysis of rural electrification will be made by Mr. B. E. Miller, of the Wisconsin Power and Light Co., and Mr. V. M. Murray, of the Wisconsin Development Authority. The developments in central station technique and practice will be covered by Mr. A. D. Bailey, of the Commonwealth Edison Co., of Chicago.

Among the papers to be read, an analysis of the development of diesel power and its significance as an increasingly important factor in our social structure will prove of special interest to all members of the conference. Mr. L. H. Morrison, editor of "Diesel Power," will comment upon the various social aspects of diesel power, and Mr. C. G. A. Rosen, of the Caterpillar Tractor Co., will discuss the technical advances made in this field.

High temperature metallurgy, always a subject of conjecture and controversy, will be discussed by Mr. J. C. Hodge, of the Babcock and Wilcox Co. With the increasing demand for new and manifold industrial alloys presenting a major scientific problem to research, this particular phase of the meeting should prove of dominant consequence to the technical world. Mr. J. J. Kanter, of the Crane Co., in a paper on the influence of creep studies upon allowable design stresses, will analyze many of the points involved in the study of welded construction.

A major problem of Chicago, and all large industrial cities, air pollution will be discussed both as to cause and cure in papers by Mr. R. V. Kleinschmidt, of A. D. Little Co., and Mr. Loyd R. Stowe, Director of Chicago's Air Pollution Survey. Equally opportune will be the texts and commentaries on railway motive power by Mr. H. P. Allstrand, of the Chicago & North Western Railway Co., and on large power plant development and operation by Mr. C. G. Daniels, of the Commonwealth & Southern Corp., Mr. A. L. Rice of *Power Plant Engineering*, and Mr. R. V. Terry, of the Newport News Shipbuilding & Dry Dock Co.

Special joint luncheons will be held in conjunction with the A. S. M. E. and the A. I. E. E. on Wednesday and Thursday. Friday will bring an inspection trip through the Research Laboratories of Armour Institute of Technology and a visit and luncheon at the Crane Co. plant.

The representatives of the cooperating colleges and universities who will attend the conference are: Edward Bennet, Chairman of the Department of Electrical Engineering, University of Wisconsin; M. P. Cleghorn, Head of the Department of Mechanical Engineering, Iowa State College; F. M. Dawson, Dean of the College of Engineering, University of Iowa; C. Harding, Head of the Department of Electrical Engineering, Purdue University; H. T. Heald, President of Armour Institute of Technology; H. B. Dirks, Dean of the Division of Engineering, Michigan State College; A. Leutwiler, Head of the Department of Mechanical Engineering, University of Illinois; A. H. Lovell, Assistant Dean of the Engineering College, University of Michigan.

Power Conferees of 1938 visit the plant of the Carnegie-Illinois Steel Corp. to inspect the South Works power equipment.

ELEVENTH ANNUAL ARMOUR RELAYS

THE running of the Armour Tech Relays on Saturday afternoon and evening, March 18, 1939, will mark the eleventh annual meeting of track and field athletes under the sponsorship of Armour Institute of Technology. As in past years, the Relays will be held in the University of Chicago Field House, acknowledged to be the best and fastest indoor track in the world. John J. Schommer, Director of Athletics at the Institute, whose initiative and energy made possible the first Tech Relay, is chairman of the committee in charge, and under his able direction success is assured.

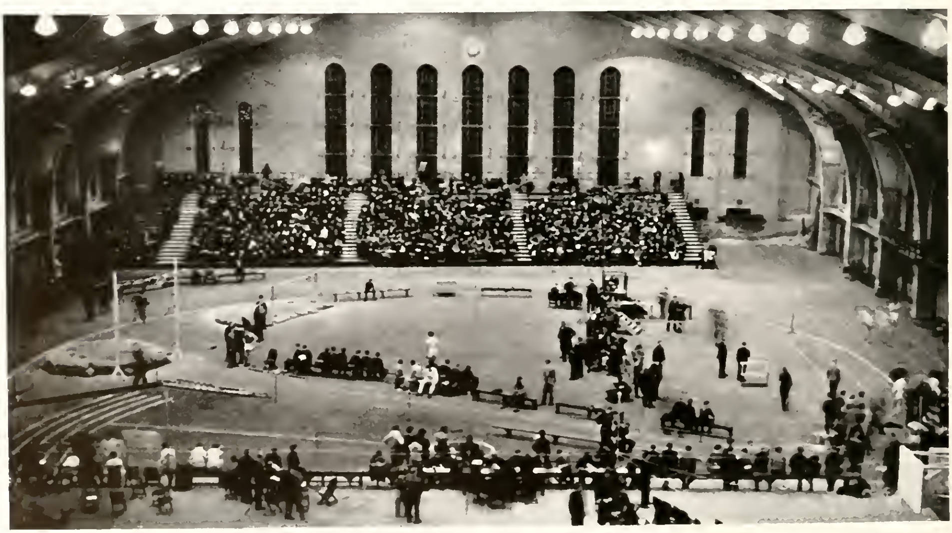
"It is expected," said Mr. Schommer, "that approximately four hundred colleges and universities in the United States will receive the first notice and invitation to the 1939 meet before March first. Last year approximately three hundred athletes entered the competition. These three hundred men represented seven middle-western states, namely: Wisconsin, Minnesota, Iowa, Missouri, Michigan, South Dakota, and Kansas. We feel justified, therefore, in sending out a larger number of invitations this year, and in expecting a larger representation of athletes."

It is to be expected that, with so large a field of participants and such unexcelled facilities, each year should produce its crop of new stars and new records. In the games of 1938 five records of previous years went by the boards. The highlight of the evening came in a special one mile run, as Charles Fenske, paced by a teammate, Walter Mehl, and two distance men from Kansas, covered the indoor mile in a planned race to ring up the fastest clay track time ever recorded in the United States. In a perfect example of technique and teamwork, Fenske covered the distance in 4 minutes, 8.9 seconds. Another thrill came the spectators' way when Charles Bechel, of Northern Illinois State Teachers, retained first place honors in the high jump for the fourth successive year. By clearing the bar a 6 feet, 6 inches, in the 1938 games Bechel set a new record for this event

The 1939 Tech Relays, accordin to present plans, will consist of pre liminaries in the afternoon and fina events in the evening. With sligh variation, the events will be the sam as those of 1938. Two divisions wil be included, college and university thus giving the smaller colleges, wh have neither the material nor the fa cilities for concentrated athletic de velopment, a chance to compete i their own class. At the same tim however, exceptional performers fro these smaller institutions will be pro vided with the opportunity to compet with their peers in the numerous ope contests.

The closed events for both division will consist of the one mile, two mil and sprint medley relays, the sevent yard dash, seventy yard high and lo hurdles, and the 440 yard run. Th open events are listed as the one mil and 880 yard runs, high jump, pol vault, and shot put.

The fieldhouse of the University of Chicago where the Eleventh Annual Armour Relays will be held on March 18.



Featuring a Special Mile Race

Charles "Chuck" Fenske, famous miler from the University of Wisconsin, who last year brought a crowd of track enthusiasts at the 10th running of the Armour Tech Relay Games to their feet when he breezed into a new American collegiate record returns this year to the scene of that triumph to make an attempt to lower that record. In this year's running, Chuck will probably be matched against three of the best distance men in the country—but first let's look at the site for this event.

As usual, this year's games, the eleventh annual, will be held in the University of Chicago field house which provides for the contestants the world's fastest indoor track in the world. Composed of a special clay and kept in tip-top condition, the track gives an outdoor aspect to racing that is not matched by any other track in the country. Again, the same fine officiating will help the special milers hang up new and better records—records which will undoubtedly crowd established world marks.

Pitted against the iron man from Wisconsin will probably be Tommy Deckard and Don Lash, both Indiana products, and a newcomer to the field of track hopefuls, Tom Smith of Chicago. In all, therefore, the special mile run will be a featured race worth seeing, and one which will be a credit to the Armour Tech Relay Games.

Taking the 70 yard high hurdles in the new record time of 8:06 seconds.

ADDITIONS TO THE FACULTY

Sven Anderson

R. G. Minarik

MR. SVEN ANDERSON is the newest appointee in the Department of Fire Protection Engineering. He is a graduate, in F. P. E., of Armour Institute of Technology, Class of 1932. After graduation he became connected with the Missouri Inspection Bureau, doing field inspection work. He is also associated with the Western Actuarial Bureau.

His hobbies are sports in general, and bowling and golf in particular. He succeeds Mr. Jarl Sorenson as Instructor in Fire Protection Engineering.

DR. R. G. MINARIK has been added to the Department of Mechanical Engineering. His undergraduate years were spent at Case School of Applied Science in his native city of Cleveland. His M. S. work was done at the Sheffield Scientific School of Yale, after which he transferred to the University of California to complete his work for the Ph. D. degree. From 1933 to 1937 he was instructor in mechanical engineering at the University of California.

Dr. Minarik has written many articles on applied mechanics. He has worked as a chemist, a construction section-hand, a consulting engineer, and as Chief Engineer for Vlchek Tool Co., the world's largest volume producer of automotive hand tools.

He is a member of Theta Tau, Sigma Chi, the A. S. M. E., and the American Society of Automotive Engineers. He is listed in "American Men of Science." His hobbies are his family (he has a 2½ year old daughter), music, and sports, as well as education.

MR. HOMER H. COOPER, FORMER TRUSTEE, PASSES AWAY

IT is with deep regret that we mark the passing of MR. HOMER H. COOPER, who, until his death, on January 28, 1939, was a trustee of the Institute and Secretary and General Counsel of the Research Foundation. Widely known in legal and academic circles in Chicago, Mr. Cooper will long be remembered for his sparkling wit and his tremendous energy and force.

Homer Cooper was born in Chicago, on September 18, 1887. He received his preparatory training in Shelbyville, Illinois, and entered the state University in 1904 as a student in electrical engineering. At the end of his freshman year, he transferred to the College of Liberal Arts where he studied for two years.

In 1906 he joined the staff of a Mattoon, Illinois newspaper and for the ensuing six years served in the various capacities of reporter, city editor, circulation manager, and general manager. In 1912 he left the newspaper and entered Northwestern University School of Law. Upon receiving the degree of LL.B., in 1914, he entered the employ of Hamlin & Topliff, attorneys.

Mr. Cooper had had the commission of Captain of Infantry, and in August of 1916 he was detailed to the Provost Marshal's Department as Supervisor of the Selective Service work for the army in Northeastern Illinois. He served the government throughout the war and until March, 1919 when he again returned to the practice of law as a partner in Hamlin, Topliff, and Cooper.

The firm was dissolved in 1930, when Mr. Cooper joined Scott, MacLeish & Falk. He became one of the trustees of Armour Institute of Technology in June, 1934, after the death of his partner, Mr. Falk, who had been a member of the Board of Trustees. He was subsequently appointed Secretary and General Counsel of the Research Foundation.

Mr. Cooper was an active and deeply interested member of the University Club of Chicago, and served for a term as president of the Chicago Bar Association.

The Institute has suffered a great loss in the death of this generous and devoted friend.

ARMOUR ENGINEER REORGANIZES STAFF

BECAUSE of the departure of D. P. Moreton on leave of absence from the Institute, the staff of the ARMOUR ENGINEER AND ALUMNUS has been considerably changed. Walter Hendricks has become Editor-in-Chief in general charge, and A. B. Lewis, formerly headmaster of the Northwestern Military and Naval Academy at Lake Geneva, Wis. and now Assistant to the President, has become Business Manager.

In addition, a group of men from various departments of the Institute and a representative of the Alumni Association have been placed upon an Advisory Board that will co-operate with the Editor-in-chief and the Business Manager in matters pertaining to the publication of the magazine. The members of this Board are: J. B. Finnegan, Head of the Department of Fire Protection Engineering, chairman; J. D. Larkin, Associate Professor of Political Science; J. S. Thompson, chairman of the Department of Physics; and Arthur H. Jens, a graduate of the Institute in Fire Protection Engineering of the class of 1931.

A group of specially qualified students, all members of a course in Writing for Publications, assist in the work of the editorial department, and other students attend to the distribution. The editorial assistants are E. L. Hass, S. A. Heeman, E. J. Kalnin, L. H. Naum, and H. E. Wessel, and the business assistant R. B. Boertitz.

Professor Moreton has left for a much-needed rest. On his return from a West Indies cruise, he will spend a few months in the south and then move up north to New England. In the past year he has been working hard and long, in spite of a general condition of physical fatigue. All will remember his valiant work in connection with the Student Union, motivated by his deep interest in the welfare of the students. It is also largely due to the activity of Professor Moreton that the ARMOUR ENGINEER was placed upon a firm business footing. For many years he was the guiding spirit of the student radio club; and the members of the faculty owe him their thanks for the splendid record of achievement he made as president of the Armour Faculty club.

All his students, past and present, and all his colleagues join in wishing him a pleasant and restful vacation, and look forward to seeing him soon in improved health and strength.

HOW WOULD YOU LIKE TO HELP FURNISH THE NEW STUDENT UNION?

WITH few exceptions, all "men of Armour" are employed at this time. During these times of stress, you alumni of Armour are indeed fortunate. Whether this is due to luck, or to your individual ability, your undergraduate training at Armour Tech had much to do with your present welfare. True, the buildings and their surroundings added little to your achievements, but the faculty of Armour, the curriculum, and you yourself, formed a partnership that has proved of service to you.

What I want to draw your attention to is that people of civic conscience materially aided you in getting your education, and would have aided you no matter what your Alma Mater might have been. These people I have just mentioned built the buildings, installed the equipment, bought the books for the library, and furnished the endowment to carry on, you paying only a part of the cost of your schooling.

The Armour Tech Alumni on our Board of Trustees (thirteen), contribute annually thousands of dollars each. Nearly all colleges, even state institutions supported by tax funds, are appealing to their alumni for help in this problem. We are now asking you to take part in the work to improve conditions for our undergraduates here at Armour. The alumni board of managers of your class will disburse the funds you contribute where they are most needed, and you can enjoy the tangible results of your giving on your visits here.

The immediate job is to raise \$10,000 to pay for the furnishings of the new Student Union. Many alumni, professors, and friends have acted together and have raised \$50,000 to remodel the Mission, the first building on the campus. Furnishings have been bought, but Armour Institute still owes for these furnishing. Your board of managers has pledged the alumni to raise this sum. We can do it! The University of Chicago raised \$87 000 last year with 307 alumni giving. Less than 200 A. I. T. alumni have thus far pledged about \$2,000.

The alumni are organized all over the country. The following men have graciously accepted the chairmanship of committees:

Robert H. Kutteruf, F. P. E. '31.
Donald J. Neal, F. P. E. '36.
Sidney Kahn, Ch. E. '12.
Walter H. Alexander, F. P. E. '27.
Lynn M. Latta, F. P. E. '25.
Edward N. Harsha, F. P. E. '24.
Howard J. Zibble, F. P. E. '35.
Ben B. Coffey, F. P. E. '26.
M. C. Nutt, Ch. E. '23.
Gerhard N. Schumacher, M. E. '23.
Albert F. Bigelow, Ch. E. '32.
Thomas Kingsley, Jr., F. P. E. '20.
J. Irving Prest, Ch. E. '18.
Wm. MacD. Horn, F. P. E. '28.
Harold S. Ellington, C. E. '08.
Charles J. Jens, F. P. E. '32.
Louis S. Green, F. P. E. '25.
Harry L. Krieger, F. P. E. '28.
Preston E. Heath, F. P. E. '30.
Otto C. Marek, Ch. E. '29.
Wm. G. Schultz, F. P. E. '32.
Deane H. Mallory, F. P. E. '20.
Harold E. Larson, E. E. '28.
Clarence W. Price, F. P. E. '27.

When a committee member calls on you (and he will) please do your share. If you were to give \$10.00 a year it would represent the price of a 3c newspaper each day. You can surely afford that much for Armour.

The lounge offers the student an attractive place for relaxation and recreation. Alumni will have difficulty in recognizing this as the old drafting room.

DO YOU WANT A JOB?

OR DO YOU HAVE A JOB FOR SOMEONE TO FILL?

By
John J. Schommer

RECENTLY, alumni placement sheets were sent to all Tech alumni with the request that they be returned promptly, but the response has not been satisfactory. Only a few hundred records have been returned and, at this time, there should be from two to three thousand in our files. These records of your achievements are for your benefit. There are many jobs for men of experience, those out of college from five to twenty years, but it is necessary that the employer know your background. You need not be alarmed that your name will be publicized if you indicate that you desire a change (whether for advancement in salary and responsibility, or to attain a wider experience in your particular field), for your placement record will be kept strictly confidential.

Last September there were 115 men of the 149 of the class of '38 out of work. There are now (March 1, 1939) but two left who have not had any employment. Many of the Tech graduates prior to the '38 class, were also out of work; these, with few exceptions are all employed.

In order to get these jobs, the placement department has used every means at its disposal. Various professors of the faculty have aided the bureau, hundreds of letters have been sent out advertising the graduates, telephone calls have kept the wires hot of the firms hiring technical help, and the people handling the personnel have been constantly contacted.

The result: nearly all Tech men are now at work, and some forty jobs remain that cannot be filled because enough of the placement records have not yet been returned.

Now, the 1939 class take their degrees this June. Here they are:

Chemical Engineers	37
Architects	17
Civil Engineers	19
Electrical Engineers	21
Engineering Science	3
Fire Protection Engineers	10
Mechanical Engineers	40
	147

Fifty-two seniors have been interviewed during the past weeks by four industrial concerns in our newly furnished placement offices which afford privacy and comfort for two separate interviewing squads. The bureau has arranged interviews for the month of March, the first of which took place Saturday afternoon, March 4.

If you need an engineer, or if you know of someone who requires an engineering graduate, drop us a line. We have the records, pictures, and other information of 147 engineers, eager for work. Why not let us try to fill your engineering employment needs?

For any information or assistance regarding placement, telephone, write, or wire the placement department at Armour and either Mrs. Constance Carroll or I will be only too glad to help you.

ENGINEERS WANTED

SALES ENGINEER: Capable of handling sales and engineering work on gas-diesel power plants $7\frac{1}{2}$ to 50 KW, also multiple unit plants up to 200 KW. Should be familiar with power distribution. Knowledge of switchboard and switch gear desirable. Detroit. Write A. I. T. Placement Department for details.

SALES REPRESENTATIVE: Fo[r] large rubber manufacturing compan[y]. Salary, commission and expenses. Nece[s]sary to have had several years' experien[ce] in selling a mechanical line. Home offi[ce] in Milwaukee. Extensive territory. Rig[ht] man can earn an income of from \$5,0[00] to \$6,000 per annum.

TOOL DESIGNER: Experienced i[n] designing small tools, jigs, fixtures, ben[d]ing dies and forming dies. Between [] and 44 years of age. Minimum salar[y] \$2,000 per annum. Illinois. Write A. [I.] T. Placement Department for details.

DESIGNER: For pumps, flow mete[rs] and control equipment. Must have ha[d] some electrical experience and must be [a] good draftsman with an artistic sense. [It] will be considered an asset if the en[]gineer has had sales experience. Perma[]nent position. Single man preferred, no[t] over 33 years of age. Must be willing t[o] go to Providence, R. I.

STEAM ENGINEER: Thorough[ly] familiar with power plant design. Execu[]tive ability essential. Must be earning [in] excess of \$5,000 per annum at the pre[s]ent time. Write A. I. T. Placement De[]partment for details.

SALES REPRESENTATIVE: On[e] who is now selling to chemical companie[s,] power plants or the oil refinery indu[s]try. Add a new line to those now bein[g] carried and augment your income. Com[]mission of from 15% to 20%. Reliab[le] Eastern firm.

ENGINEER: Experience in paper in[]dustry $1\frac{1}{2}$ to 2 years (not laboratory ex[]perience). Preferably operating and en[]gineering experience. Under 30 years o[f] age. Married or single. Eastern fir[m.] Write A. I. T. Placement Department fo[r] details.

These and numerous other jobs ar[e] available. If you have not alread[y] done so, please send in your plac[e]ment record form.

John J. Schommer,
Director of Placement.

LETTERS FROM THE ALUMN

Henderson '02 Construction Executive

UNITED Engineers & Constructors Inc., Philadelphia, has announced the election of Roy M. Henderson as Vice President in the middle section of the United States with headquarters in Chicago.

Mr. Henderson received the degree of B. S. in Electrical Engineering from Armour Institute of Technology in 1902. He was associated with Dwight P. Robinson & Company until it was merged with the United Engineers & Constructors, Inc., in 1928. For several years after the merger Mr. Henderson served as President of the Canadian subsidiary corporation in Montreal.

His experience has not been altogether in strictly electrical engineering but has included construction and executive activities. Four years of experience in foreign assignments in Mexico, Europe, and South America have helped to broaden the scope of his activities. In the construction phase Mr. Henderson has been connected with the Lincoln Building and the Warwick Hotel in New York, the London Guarantee & Accident Building in Chicago, and many other large apartment, hotel, and office buildings in New York, Philadelphia, and other cities.

Boberg, '36, Combines Law and Engineering

Dear Sir:

Things are certainly busy down at our place. I'm getting in on all the big jobs. Our next one is an interference hearing before the Patent Office Board of Appeals, a couple of weeks from now. Never a dull moment at our office.

I'm attending night school at Loyola School of Law. Quite a few engineering graduates are working themselves into the legal profession. It seems to be quite necessary for a fellow to have both types of training nowadays before he can expect to get anywhere, unless he's an unquestioned genius in some phase of engineering, of which, I might add, there are darn few.

Sincerely,

Charles P. Boberg, B.S. in E.'36,
6758 Calumet Ave., Chicago, Ill.

Kreiman, '38, Enjoys Kentucky

Dear Editor:

Greetings from the land where corn liquor and beautiful women are to be found at every turn. Greetings from Louisville, the gateway to the South, where you are welcomed with a friendly smile and open arms, by male and female alike.

. . . The gods who control my des tiny have apparently favored m with a smile. Last July, on a blin chance, I hitch-hiked to Louisville an applied for a position on the engineer ing staff of Seagram & Sons, distill ers. After a lengthy personal an technical interview I was given th surprising news that I was a success ful candidate for one of two availab positions.

These past five months have prove to be anything but child's play. Work ing nights, and on twenty-four hou call, I've operated stills, cookers, an grain mills, superintended ferment ing operations, and nursed along tem peramental yeast cultures. However all that hard work is now beginnin to bear fruit.

I am too a member of a sele group of young engineers who are t receive special instruction in advance distillation practices, spirit produ tion, blending, cost accounting, an marketing. All this is to fit us fo executive positions in the variou plants throughout the couuntry. Fo other Armour men, Robert Clark B.S. in Ch.E.'37, Louis Kaecl, B.S. i Ch.E.'37, Louis Siegel, B.S. in Ch.I '36, and Gan Eng, B.S. in Ch.E.'3 are also making splendid progress i the firm.

Save the Date . . . .

TUESDAY, JUNE 6, 1939, 6:30 P. M.

ANNUAL ALUMNI BANQUET

MEDINAH ATHELETIC CLUB, AS USUAL

If everything continues as it has een, it will not be long before I shall uake a trip to Chicago and bring back bride. Can't think of a better in-entive and inspiration for hard work.

Yours truly,

Sidney Kreiman, B.S. in Ch.E.'38,
319 West Lee St., Louisville, Ky.

Vesterman, '31, Keeps Us Posted

Dear Sir:

For the past two years I have been raveling Northern Ohio for a Chi-ago industrial fire insurance firm. Occasionally I see other Armour lumni in these parts, and if you hould need any information on any f the "lost, strayed, or stolen" who night be hereabout, I may be able to elp you. In case you have not heard, am enclosing some facts about sev-ral of the boys I meet from time to ime. [Ed. Note: See Wilson, '31, Vheaton, '35, and Lamb, '29.]

There are quite a few others I see nd hear about, but the above repre-ent changes that may be new to you.

Best regards.

Sincerely,

Claude M. Westerman, B.S. in F.P.E.'31,
11095 Lake Ave., Cleveland, Ohio.

Fogle, '36, Is an Expectant Father

Dear Editor:

. . . I thought some of the members of the class of '36 would like to hear about things from a Cleveland member.

I was employed by the Carrier Air Conditioning Corpn. several months after leaving the Institute, going through the training class in Newark, New Jersey. I worked in the Philadelphia office for several months, then the Chicago Office for six months, then the Cincinnati office as assistant manager for a year, and am now district manager in the Cleveland office. While I was in Cincinnati I took a special trip to Middletown, Ohio (about fifty miles from Cincinnati) to look up Johnny Larson, B.S. in C.E.'36. He was out of town at the time. I talked to the woman who operated the Inn that Johnny was staying at, and she said he was getting along fine with his work with Steel Buildings, Inc.* While on a business trip that took me into southern Kentucky, I looked up Ray Petersen, B.S. F.P.E.'36. My wife and I had dinner with Ray in Lexington, and before we left he gave us a bottle of genuine Kentucky "corn." Ray is a little heavier than when he left Armour.

Thought that some of the "Fighting Civils" of '36 especially might like to know that the writer is an expectant father. The "big event" comes off in April, and if it's a boy he will certainly send in his application for a scholarship exam.

Would like to hear from some of the old gang if they can find the time.

Yours very truly,

William H. Fogle, B.S. in C.E.'36,
c/o Carrier Corp., Union Commerce Bldg., Cleveland, Ohio.

[*The alumni records now show that John O. Larson is with Proctor & Gamble Mfg. Co., Ivory Dale, Cincinnati, Ohio.]

Pantone, '38, Discovers Los Angeles

Dear Editor:

Here I am in Los Angeles, and having a grand time, too. Most of the houses are one-storied—shockproof,

they say—and copied after a form of Spanish or Mexican adobe. There are also some colonial and New England type of homes.

Most of the people are from somewhere else; that is, there are very few natives. Only this morning I ran into a young man who was from Burlington, Vermont. He was having a tough time of it, and was trying to raise money to get back home. He left a good job to seek for opportunity in the Golden West. And so it is with a great many of the people here. Some are fortunate and get jobs and stay.

It's really a swell place to live. Others come out with money-making schemes, legal and illegal, schemes for everything; and they're very ingenious, too. There are all kinds of groceries, clothing stores, gas stations, and lunch rooms. Everyone tries to do one better. One gets very courteous, efficient, high-pressured service. Competition is terrific. They know suckers, too. Generally speaking, Los Angeles is unique as compared with other big cities.

My activities have been other than that of a mere observer. I've been looking for work. Though unsuccessful as yet, I have not given up hope. I've made a number of inquiries in the movie industry and I find that there is practically nothing for an engineer. R.K.O., for instance, employs two engineers. One works in the light department, and the other, one Aalberg of Armour, class of '24, as head of the sound department. All of the workers in these departments are members of strong unions. These workers' salaries range from $1.20 to $1.95 per hour, with all kinds of compensation for overtime. It would be nice to make that salary, but that wouldn't be engineering. Right now I'm about to embark on a quest for work in the airplane industry. They have use for more engineers than the movie people. And so, wish me luck.

Yours sincerely,

Michael Pantone, B.S. in E.E.'38.

Paul Moore, '37, Is Up in the Air

Dear Secretary:

. . . Yes, the graduation exercises at Kelly Field meant that I was to be transferred, for upon completing the work at the Air Corps training center I was given a Commission the Air Reserve and assigned to acti duty. I am at Selfridge Field, Mic igan, with the First Pursuit Grou 27th Aero Squadron. I might me tion that I am very happy about t assignment, because the 27th Squa ron acquitted themselves with distin tion in the World War, having t famous Frank Luke and several wor famous Aces among their number.

Very truly yours,

Paul L. G. Moore,
2nd Lieut. Air Reserve.

Wermuth, '16, Makes a Splendid Record

February 16, 1939.

Dear Editor:

Some time ago, I called at the offi of a very close friend of mine a while waiting for his arrival fr lunch, I glanced over to a table a noticed a publication entitled Armo Engineer and Alumnus. I re through the pages of this magaz with much interest. The publicati itself is one of the most splend pieces of journalistic work it has be my pleasure to observe.

The thought came to my mind what a fine idea it would be to c

your attention some facts about an mnus from your college who has de an unusual success in the enieering world. The record that this ntleman has already established will g serve as a reminder of his conoution to the engineering world. s success came as a reward after uy years of hard work.

I recall his own story when he went Chicago shortly after being mar-d. He was only 18 years of age en he married. He was determined get his engineering degree from mour. It was that determination t sent him out to find a part time so he would be able to finance his y through school. He took a job time keeper on one of the river ojects in Chicago. The gentleman t I have pictured to you is MR. FRED C. WERMUTH, a gradie of your college in the class of 6. I am reproducing the article vrote in 1928 relative to Mr. Werith: . . .

"The writer of this article during past summer, while in a private rary, found among several valuable oks a small pamphlet with the word *dron* printed in large letters on the title page. I did not realize at the time that the gentleman I was visiting was a former Central graduate, until I began to look through the *Caldron*. On the title page was printed a picture of a ship about to embark out into the high seas of life. . . . Turning to the class officers I found that the gentleman I was visiting, Mr. Alfred C. Wermuth, was president of the senior class of 1912. After graduating from Central in 1912, Mr. Wermuth entered Armour Institute of Technology, from which he graduated in 1916. Upon graduating from this institute, Mr. Wermuth returned to Fort Wayne, where he established his contracting business.

"The latest buildings of recent construction built by Mr. Wermuth in this city are the International Harvester Company and the Trinity English Lutheran Church. After the completion of this church, Mr. Wermuth moved his business to Detroit, where he is now located. At the present time Mr. Wermuth is doing construction work on the private 350 acre estate of Mr. George G. Booth, former publisher of the *Detroit News*. Mr. and Mrs. George G. Booth created a deed of trust known as the Cranbrook Foundation several ago for the erection of Cranbrook School, Brookside School, and Kingswood School.

"The expenditure for these buildings covers several millions of dollars. Cranbrook School which is a preparatory school for boys from the 7th to the 12th grades has already been completed. This school is laid out similar to the English private schools. Several outstanding authorities on architecture have considered this school as one of the finest pieces of architecture in the United States. Mr. Eliel Saarinen is the chief architect for these buildings. Brookside School, an elementary school for boys and girls from kindergarten through the 6th grade has also been completed. Kingswood School, a preparatory and cultural school for girls from the 7th through the 12th grades, is now under construction and is to be completed in the fall of September, 1931. The members of the faculty of the school reside a short distance from the school buildings in faculty row.

"Every advantage and opportunity is given to the student who attends

these schools. A headmaster is in charge, and every student's work must rank by the standards set by the faculty. Recreation takes a leading part in the outside activities of the school. The student has hand ball courts, tennis courts, swimming pools, horseback riding, and golf, in any of which he may participate. This school is easily reached by motor from Detroit. The estate lies a short distance from Bloomfield Hills, Michigan, which is a mile and a half from Birmingham, a suburb of Detroit."

* * *

It may interest you to know that Mr. Wermuth spent about ten years in completing the above layout. You may also be interested in knowing that the Cranbrook School for Boys was awarded second place in the International Architecture Contest sponsored by the *Chicago Tribune* a few years ago. Other outstandings pieces of engineering work completed by Mr. Wermuth and his firm, Charles R. Wermuth & Sons, Inc., are the $750,000 residence of Mr. Alvin MacCauley, president of the Packard Motor Car Company, located in Grosse Pointe; Indianapolis Sewage Disposal Plant; Medical Building, Indiana University School of Medicine; Purification Plant, Ann Arbor, Michigan; Y. M. C. A. at Springfield, Ohio, and the Stockwell Memorial Hall and Fine Arts Building, Albion College, Albion, Michigan.

Mr. Wermuth is 45 years of age, married, and has four children. He resides at 2423 South Fairfield A nue and maintains an office at 1(Saint Mary's Avenue, Fort Way and the other office in Birmingha Michigan. . .

Very sincerely yours,

GORDON FOSTER

140 East Masterson Avenue, F Wayne, Indiana.

ALUMNI NOTES

1909

The widow of ATLEE C. RIKER informs us that Mr. Riker, B. S. E. E., passed away some months ago at Casper, Wyoming. We extend our sympathies.

1910

Our regrets are also extended to Mrs. E. M. Henwood, widow of PROCTOR E. HENWOOD, B. S. M. E., whose death was due to a severe heart attack some time ago. Since 1922 he was Associate Professor of Machine Design in Mechani Engineering at the University of I nois. He is survived by his wife a three children.

1912

CHESTER A. SNOW, B. S. P. E., has recently been made sec tary of Phoenix of Hartford, add another step to the steady rise wh has characterized Snow's career si he became associated with the Phoe Insurance group in 1912. A native Chicago, he started with the comp

ere and worked in the middle west ntil he was called to the home office n 1928. At that time he became su- erintendent of the special risk de- artment and his activities are still rimarily in that field. Snow was nade assistant secretary in 1936, and eld that position until his recent pro- notion.

1913

BRUCE A. YOUNG, ex-M. E., re- ently received one of the Carnegie ero medals awarded to two Chicago- ns for risking their lives in saving thers from drowning.

Young, who is now the superin- ndent of a printing company, saw wo small boys break through the ice n the Douglas Park lagoon on March , 1938. The two boys, ages eleven nd eight, had gone out on the thin e and were ninety feet from shore ten feet of water when Young swam rough an open channel to the res- ie. Reaching them he found one of ie youngsters unconscious and the her dazed but he held both of them ith one hand and swam to shallow water where a bystander helped them to the shore.

1929

CHARLES D. LAMB, B. S. F. P. E., has been transferred from Cleveland to Columbus, Ohio, for the Aetna Life Companies. Residence, 1995 Tewksbury Road, Upper Arlington, Ohio.

1930

MORRIS O. NELSON, B. S. C. E. '30, is the proud father of a baby boy. He lives at 7934 Morgan Ave., Chicago.

1931

ROBERT N. WILSON, B. S. F. P. E., resides at 469 Front St., Berea, Ohio, and is now State Agent for the Niagara and American Eagle Fire Ins. Companies, 747 Union Commerce Bldg., Cleveland, Ohio, having been recently transferred from Indianapolis.

1932

F. DAVID CHAPMAN, B. S. Arch., is engaged to Miss Eileen Nancy Ryan, a student at Bennett's Junior College in Millbrook, N. Y. The wedding is to take place in June.

1933

ELMER E. SADEMAN, B. S. F. P. E., is now engineer in the office of the western department of the National Fire Group, 175 W. Jackson Blvd., Chicago. He was formerly connected with the Ohio Inspection Bureau in Dayton, Cleveland, and Cincinnati branches as an inspector.

IRVING SIEGEL, B. S. Arch., is connected with the Architectural section of the Subways and Traction Dept. of the City of Chicago, with offices in the Civic Opera building.

1934

WALTER F. KROL, B. S. Arch., is also in the Architecture Section of the Subways and Traction Dept. of the City of Chicago.

1935

ALEXANDER KULPAK, B. S. M. E., spent a nice trip this summer touring Europe with the Ukrainian chorus.

WILLIAM WALLACE HENNING, BS M. E., is the proud father of a bouncing baby girl. Congratulations!

RAYMOND J. MACI, B. S. M. E., returned a short time ago from a vacation in Florida.

GEORGE WILLIAM WHEATON, B. S. F. P. E., was recently appointed Special Agent for the Firemen's Fund Ins. Companies for northern Ohio, with headquarters at 878 Union Commerce Bldg., Cleveland.

The Mechanicals of the class of 1935 have had two technical sessions. At the first meeting HENRY MAYEROWICZ talked on Air Conditioning and CHARLES K. GOLDBERG gave pertinent facts on Punch Press Design. At the second meeting WILLIAM HENNING was toastmaster and gave an interesting talk on a number of engineering problems he has had to solve.

On January 20 the Mechanicals held their fourth annual group meeting at Hotel Stevens. Fifteen attended. RAYMOND J. MACI and JOSEPH H. DeBOO were reelected, the former as vice-president and historian, the latter as secretary-treasurer. IRVING MEZERA was initiated as a new member into the organization.

1936

RALPH BLAINE PRIESTLEY, ex-B. S. Arch., was married to Miss Mary Jensen of 1520 East 72nd Place on March 6 at St. Johns M. E. Church, Chicago. Mr. Priestley attended Armour Institute for a few years, finishing his studies at the University of Illinois, in 1936. He is employed by Joe H. Wildermuth & Co., Ogden Bldg., Gary, Indiana.

WILLIAM BILL, B. S. E. E., was married last Thanksgiving Day. He has been working on a rural electrical project in Newaygo, Michigan, but is now back in Chicago.

MAURICE SHIU, B. S. E. E., and wife are the proud parents of a son.

1937

PAUL L. G. MOORE, B. S. C. E., graduated on February 1, from Kelly Field, Texas, as Lieutenant Air Corps Reserve, United States Army.

IAN IKENN, B. S. C. E., is working on a subway design for the Subways and Traction Commission of th[e] City of Chicago.

1938

EMIL LADER, B. S. Arch., with Joe H. Wildermuth & Compan[y], Ogden Bldg., Gary, Indiana, workin[g] with Priestley, ex. '36. Lader recentl[y] had a brief article on the subject [of] "Wood" in *Pencil Points*.

RAYMOND A. KLIPHARDT, B. S. Arch., is teaching mechanic[al] and free-hand drawing at North Par[k] College, 3225 W. Foster, Chicago, Il[l].

STANLEY E. HEALY, JR., M. E., is connected with the Subway and Traction Commission of the Cit[y] of Chicago, detailed to work on a sub[-]way design.

The following are inspectors [of] P. W. A. projects, at present in Chi[-]cago, but may be sent anywhere [in] the United States: CLIFFORD [W.] CARSTENS, B. S. E. E.; FRED ENGELTHALER, B. S. M. E[.]; DANIEL HORWICH, B. S. M. E[.]; GEORGE C. MADGOURANI[S], B. S. C. E.; GEORGE A. PALK[O], B. S. E. E., and FRANK A. P[A-]LONIS, B. S. C. E.

OCIAL AND ECONOMIC BENEFITS OF THE SUBWAY (From page 7)

o to date, and Chicago could be made e great city it was planned to be in is document.

It is impossible to forecast what ill occur tomorrow. Plans for a great oject, such as the subway, are based ly on the facts we have at hand, and e do the best we can to provide for e future by judging the developents of the past. We cannot say ith any degree of certainty just what e transportation of the future and effect will be. The World's Combian Exposition and new transportion moved Chicago south. The elevated moved it north and created the Wilson Avenue and other districts from territory that was open country at the time the elevated was being built. Elevated and motor transportation is superseding street car travel, the motor bus is developing; no one can say where this development will carry us, and what subways can do is largely a matter of conjecture. The city has extended outward steadily and the many districts have fallen into rack and ruin to the great and lasting detriment of the city, but we believe that subways and improved transportation will work vast improvements in these areas.

In my opinion, the building of the subway will start us back on the road to a greater Chicago and put us in a position to resume our growth and improvements which have so long been hampered by the continuous dilly-dallying with the traction problem and the subway question. I should like to state again, that most of these social and economic benefits cannot be realized unless there is brought about a unified transportation system, properly coordinated and operated.

HICAGO DIGS A SUBWAY (From page 12)

uch of the work proposed on State reet, Dearborn Street, Lake Street, d the southeast section of Milwaue Avenue extends through the aces now occupied by these tunnels. efore starting work it will be necsary for the contractor to provide ght bulkheads on all side tunnels to avoid the loss of air. It should be understood, however, that the subway project will not cause the suspension of the operation of the freight tunnels. This comprehensive network of underground freight tubes covers almost every street in the downtown district and therefore has great flexibility. The Tunnel Company may plan the restoration of cross connections along a number of the more important loop streets extending from a point west of Dearborn Street to a point east of State Street. These new connections would be constructed with an approach gradient of about 3 per

cent at either end, passing under the Dearborn and State Street Subways.

What Will Happen to the State Street and the Lake Street Bridges?

The inadequacy of the old State Street bridge has been recognized for years, and a new bridge has been planned since 1930 when a bond issue for a new bridge was approved, so that funds are now available. A joint bridge and subway construction program has been prepared with the cooperation of the City Bridge Department, which provides for the removal of the existing structure after the completion of the repairs to the Dearborn Street bridge now under way, or in May, 1939.

The river crossing will be made by the same method as was utilized in the construction of the LaSalle Street tunnel more than twenty-five years ago. Steel tubes will be fabricated on shore, floated and towed to the site of work and then sunk in a dredged trench. Closure of the water sections with the land sections will be made by coffer dams on each side of the channel. The work under the abutments of the proposed new State Street bridge will be done in cooperation with the Department of Public Works. Present bridge plans call for the construction of large girders over the twin tunnel sections spanning between the caissons on either side of the tunnel.

The Lake Street bridge is a modern double deck structure—in the construction of which 30 foot openings were left in the abutments to provide for future subways. This is an insufficient width to accommodate a twin tube, so that a double deck tunnel structure is planned for this crossing, which, incidentally, facilitates the flexing of tracks at the intersection of Milwaukee Avenue and Lake Street (future) subways.

What Will Be the Immediate Benefits in Saving of Time?

Some understanding of the existing rapid transit operation is essential to a proper estimate of the benefits of the initial subway project. At present, trains from four tracks on the north side, six tracks from the northwest, west, and the southwest sides, an three tracks from the south side oper ate through a two track throat at th union loop. As a result, 68 trains ar frequently operated through th throat over a single track during th maximum hour as compared with practical maximum of 40 trains pe hour for efficient rapid transit opera tion. The result is delay and loss c time during the morning and evenin rush hours. The initial subways wi provide track facilities for more tha 10 per cent of the present traffic ove the union loop, thereby decreasing th load on the tracks to a degree tha will permit efficient operation an eliminating the delays inherent in th present situation, often as much a five or ten minutes.

In addition, there will be substan tial time savings resulting from th more direct alignment and the su perior subway station layout, totalin almost 12 minutes for through-rider between the north and south side— minutes to the north, and 3½ minute to the south. In the case of the Dea born Street Subway, there will be

12 minute reduction in running time for trains from the Logan Square and Humboldt Park branches.

Can the Loop Structure Be Removed?

The construction of Dearborn Street Subway, Route No. 2, as provided in the initial subway project, will relieve a long felt need for more direct transportation between the northwest side and the central business district. However, the stub terminal operation which will be required temporarily at the south terminal, will not permit the development of the full utility of this unit. Clearly indicated additions consist of a subway connection from Lake Street and Milwaukee Avenue to the Lake Street elevated structure just west of Halsted Street and the construction of a subway connection along the line of Congress Street extending from the temporary south terminal south of Van Buren Street to a connection with the four-track Metropolitan elevated main line near Halsted Street. When it is completed in this manner, trains from Logan Square, Humboldt Park, and Lake Street can be through-routed to Garfield Park and Douglas Park, turned back at permanent tail tracks to be located south of Van Buren Street, or looped back on the Garfield Park elevated to the Marshfield Junction and the Northwest Branch along Paulina Street.

Upon the completion of the West Side rapid transit subway, as thus indicated, the only service operated over the union loop would be north-south side trains not operated through the State Street Subway (elevated tracks on Wells and Van Buren Streets only). Thus, the elevated structure on Lake Street and Wabash Avenue could be eliminated. The ultimate construction of an additional two-track subway extending north and south along the westerly side of the central district would permit the final removal of all of the elevated loop structure.

What Additional Subways Are in Prospect?

The city's program, as set forth in the 1937 report to the City Council, includes the construction of street car subways on Washington Street and Jackson Street extending from west of the Chicago River to Grant Park. These subways would provide for the operation of all of the street cars from the west side, thereby freeing all of the east and west streets in the loop district of street car traffic and thus greatly increasing the roadway capacity. These subways would also provide convenient facilities for delivery of passengers from the Union Station, the Chicago and North Western station, and the Illinois Central suburban stations at Randolph Street and at Van Buren Street, with various intermediate delivery points in the central business district. These street car subways estimated to cost $11,-100,000 are not a part of the initial subway project, but are definitely a part of the city's subway program.

In the preparation of the plans for the initial subways in the loop district, care will be taken to provide space for such high level subways as may be required in the future on east and west streets.

Are Two-Track Subways Adequate?

Attention is frequently called to

four track subway development in New York City and the question raised as to why two track subways are to be built in Chicago. Four track subways are required for only two purposes: to provide express operation through by passing stations, or to provide necessary track capacity.

Attention is called to the fact that the initial Chicago subways are located almost entirely in the central terminal district, and there is no necessity for by passing any of the stations in this area. The situation is almost similar to that existing in the downtown section of New York, where trains from four track subways are operated over two tracks only, making all station stops. There is no necessity for by-passing either the stations in the loop district or any of the nearby stations, and, as a matter of fact, it would be advisable to stop all trains at all stations even if four tracks were to be constructed.

The only justification for four track subways would be the necessity for additional track capacity.

As stated before, the initial subways are planned for rapid transit train operation. Before the policy of constructing two-track subways was determined and finally adopted, thoroughgoing analyses were made of present and probable future loads. Two of the most important factors considered were the trend in business activities and the number of passengers traveling to and from the central business district. Cordon counts made on a typical week-day in various years covering the period 1926 to 1938 inclusive—of traffic to and from the district bounded by the Chicago River on the north and west and by Roosevelt Road on the south—show a reduction in total passengers carried to this district by street car, bus, and rapid transit. However, the total number of passengers reaching this area by all means of transportation, including private automobiles and taxicabs, has been more or less constant. While the central business district of Chicago is, and will continue to be, the most important focal area in the city, the activities formerly confined to this district are spreading beyond the river to the north and to the west. In addition, there has been a definite tendency toward decentralization during the last ten or fifteen years, and many of the activities formerly carried on in the loop are now found in thriving urban and suburban sub-centers.

The maximum capacity of two-track rapid transit subways is developed by assuming the operation of forty trains of eight cars each per hour. Cars with maximum dimensions of 9′-6″ in width and 60 feet in length are contemplated. With an average loading of one hundred passengers per car, such an operation will develop a capacity of 32 000 passengers per hour per track. Upon the completion of rapid transit subway routes No. 1 and No. 2 (with connections to Lake Street and Garfield Park elevated structures) and with the use of existing rapid transit tracks on the Wells Street and Van Buren Street legs of the union loop, there will be three double-track rapid transit railroads serving the central business district with a total capacity of 192,000 passengers per hour, or 96,000 passengers in the maximum half hour. This total capacity may be compared

with the present total rapid transit, street car, and motor bus combined load of less than 90,000 in the maximum thirty-minute period. Considering the fact that convenience requires the retention of some local bus and trolley car routes at street grade, we may conclude that this terminal subway layout will provide adequately not only for the present, but for future traffic for years to come, and that the city is warranted in constructing two-track subways—especially if a large number of north-and-south and east-and-west streets are left open for future subways when, as, and if required.

Conclusion

Upon the completion of a reorganization plan providing a new company to take over and operate all of the facilities owned and operated by the Chicago Surface Lines and the Chicago Rapid Transit Company, the city will be able to complete its negotiations for a new franchise. This will permit the city and the new company to embark on a tremendous program of modernization and extension of all local transit facilities.

Rapid Transit:		
1,000 modern cars—all steel—wide	$25,000,000	
Complete block signal system—automatic train control	4,355,000	
Subway equipment and elevated connections	7,105,000	
Improvements to present cars, structures, stations, shops, station relocation	9,985,000	
		$ 46,445,00
Surface Lines:		
Replacement 155 C. M. C. buses	$ 1,700,000	
Replacement 3,100 street cars with cars or buses	46,700,000	
Track rehabilitation	13,975,000	
Other Surface Lines improvements, including car houses, garages, shops, terminals	9,870,000	
		72,245,00
Subways:		
Initial System	$40,000,000	
Complete the West Side Subway	11,000,000	
Jackson and Washington Street Subways	11,400,000	
		62,400,00
GRAND TOTAL		$181,090,00

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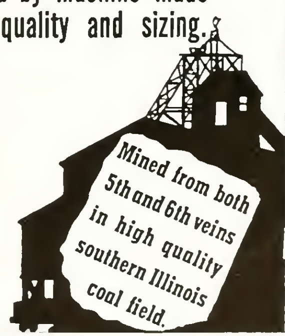

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Quenching tang you find in
Rare old champagne.
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AND ALUMNUS

MAY 1939

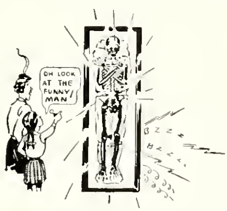
G-E Campus News

IT CUTS SOME ICE

NICODEMUS, the brown-nosed seal, playfully swam up to the North Pole, tripped the circuit-breaker and plunged Santa's workshop into darkness.

Absurd? Not as far as the successful operation of G-E outdoor air-break switches is concerned. These have been placed in a special room in the General Electric Research Laboratory at minus 20 degrees Fahrenheit, sprayed with water, and tested when coated with ice to a thickness of one and a half inches. The powerful leverages shattered the ice as easily as a walrus swallows a fish. In each case the switches opened and closed properly.

This test is just one of the many which G-E equipment must pass. And the observers, who check the operations with pitiless eye, are members of the G-E Test Course—young college men in their first year with the Company.

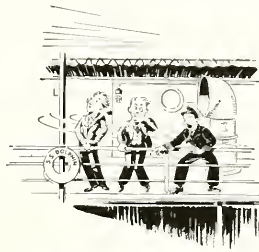


OH! MUMMY...!

A SKELETON in the closet—a white-robed ghost in the attic—even Ichabod Crane's headless horseman may well feel jealous of Harwa, the Egyptian mummy. For while conservative ancestors content themselves with rolling in their graves in a genteel way, Harwa is floodlighted in a golden glow in full view of the public in the G-E building at the New York World's Fair.

This unusual exhibit is designed, not to frighten women and little children out of their wits but to demonstrate one of the many uses of x-rays. By pressing a button, an x-ray machine is turned on, and an image of Harwa's skeleton appears on a fluorescent screen which moves in front of the mummy. The principle employed is the same as that by which a doctor may fluoroscope a broken bone, except that the entire body of an adult person is viewed.

Harwa lived 2800 years ago, in Egypt. From inscriptions on the coffin lid it is learned that he was overseer of storage houses on the great farming estate of one of the temples of Amen, chief god of the empire. Pathological study of the mummy by means of x-ray indicates that Harwa was probably forty years old at the time of his death. And now, nearly 3000 years later, he is in his portable grave, a citizen of ancient Egypt in the World of Tomorrow.



FLOATING POWER

THE surging waves of a stormy sea are beautiful to an artist, disconcerting to a food-loving passenger, but just another problem to an engineer. Whenever a sleek, ocean liner plows her bow through a heaving swell, her engines feel an added load, and her captain wonders if the fuel will last. So, G-E engineers built an all-electric meter that will accurately measure the power put out by the propeller of any boat, from a tiny tug to a transatlantic greyhound.

The meter is essentially a combination of two electric generators mounted a little distance away from each other on the propeller shaft, and connected to instruments which can be located at any point on the ship. The generators are so mounted that at no load the voltages generated are exactly 180 degrees apart in phase and therefore add to zero.

When a load is placed on the revolving shaft, the torque causes a small angular twist in the shaft; consequently, the two generated voltages no longer add to zero. The resultant voltage is proportional to both the shaft twist and the propeller speed, and hence the meter can be made to read directly in horsepower. The installation can easily be modified to indicate total horsepower-hours and to write an automatic log of the power delivered during the trip.

Among the G-E engineers who developed the device are A. V. Mershon, Pratt Institute '13 and Union College '15, and C. I. Hall, U. of Illinois '1[illegible].

NEW YORK WORLD'S FAIR — SEE THE G-E "HOUSE OF MAGIC" — SAN FRANCISCO INTERNATIONAL EXPOSITION

GENERAL ELECTRIC

ARMOUR INSTITUTE OF TECHNOLOGY IS BUILDING WITH CHICAGO

ARMOUR ENGINEER AND ALUMNUS

May, 1939 VOLUME 4 NUMBER 4

IN THIS ISSUE

ALUMNI SECTION

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FROM SICKLE TO COMBINE

By
Sydney G. McAllister

THE problem of the harvest is immemorially old. We do not know, nor can we guess with any accuracy, the time of its origin. The problem existed as soon as man ceased to be exclusively a carnivorous creature and began to scratch the soil and cultivate grains for his food.

Before the invention of the reaper, men lived in subjection to the soil, bound to hard labor by the needs of their hunger. The century since its invention by Cyrus H. McCormick in 1831, has witnessed man's rapid emancipation from that slavery. Today he subjects the soil to his wishes.

Until about 100 years ago, reaping meant hand labor. There were a few spasmodic attempts to develop power machinery, such as the Gallic header of ancient Rome or the devices of Ogle and Bell in England, but all of them proved impracticable for general use. The hand tools, the sickle, the scythe, and the cradle, were universal.

The simple sickle, a short, curved blade with a short handle on one end, dates from prehistoric time. The average reaping capacity of a man with a sickle was about half an acre of grain a day.

The scythe has been known and used since the days of the early Egyptians. It consists of a thin curved blade attached at right angles to one end of a long handle. The handle is grasped in both hands and the blade is swung with a rhythmic motion, cutting and depositing the grain in swaths. With a scythe a man could cut about two acres of grain a day.

The cradle, a natural evolution of the scythe, has been known since the fifteenth century. It consists of a frame of straight wooden fingers parallel to the blade of the scythe and attached to the handle. With it a man could cut about two acres a day. Its advantage was that the grain fell uniformly, with the heads in one direction and in good condition for binding into sheaves.

It was not until the eighteenth century and the English agrarian revolution that real striving toward a reaping machine began. Numerous experiments were conducted between 1760 and 1831 when the McCormick reaper appeared. Most of them failed. In general, the early machines fell into two classes: those which attempted to do the job by rigging some sort of revolving, multi-bladed scythe, and those which utilized the principle of the scissors. The machine invented by Henry Ogle in 1820 contained some of the principles later found necessary in a successful reaper but failed of adoption as the result of its own flaws and the open hostility of farm hands.

When Cyrus H. McCormick produced his machine in 1831 it contained seven principles which have been found essential to all successful reaping machines built since that date. A review of them gives a clear and rather complete description of the McCormick reaper. They were: 1. A

Lower left: The original reaper at work in the field with its two-man crew, one to ride the horse, the other to reap grain from the platform.

Below: McCormick's Old Reliable automatic self rake reaper of 1894 at work in the field. Note how the mechanical rake swept the cut grain off the platform and deposited it in bundles ready to be bound.

straight knife with serrated edge and a reciprocating motion, to cut the grain. 2. Fingers or guards projecting forward from the knife to hold the grain while it was being cut and prevent it from slipping sideward. 3. A revolving reel to press the grain against the knife and tip it backward as it was cut. 4. A platform behind the knife to catch and hold the cut grain. 5. A master wheel to provide power, through ground traction, to drive the knife and reel. 6. Forward draft from one side so that the draft animal did not walk in the standing grain. 7. A divider at the end of the cutter bar to separate the standing grain from that which was to be cut.

It is significant to note that, although the individual devices underwent many refinements from the original machine either at the hands of the inventor or his successors, none of these seven principles has ever been dropped nor have any basic additions been made.

Although McCormick was the first man to invent a successful reaper, he was never without competition in exploitation of the business. Three years after his invention the *Mechanics Magazine* blossomed with an account of a so-called reaper invented by a Cincinnati candlestick maker and former sailor named Obed Hussey. Since the Hussey machine contained some principles previously incorporated in the McCormick machine, which had been successfully and publicly tested well in advance of Hussey's device, McCormick wrote the editor of the magazine, claiming priority in these principles. The unexpected rivalry also led McCormick to seek a patent immediately. Some years later, after much controversy, Hussey admitted the priority of McCormick's rights, although he continued to build and sell his machine as a reaper for many years.

Hussey's machine was mounted on two wheels and operated from them. It had no reel. Its cutting apparatus was different from McCormick's, although the toothed cutter bar, having a reciprocating motion and fingers or guards extending before it, was essentially the same.

In later years it was generally acknowledged that Hussey's machine was better adapted to mowing grass than to reaping grain, whereas McCormick's was more successful as a reaper than as a mower. Those who later built mowing machines copied Hussey; those who built reapers, McCormick. The original patents of both Hussey and McCormick expired in 1848.

The next major development in the reaper was an ingenious and complicated self-rake device patented in 1852 by Jearum Atkins. In using the original reaper it was necessary for a man to walk behind it to rake the cut grain from the platform for binding. Atkins' device cleared the platform automatically. It was followed in 1860 by an invention of McClintock Young which consisted of a revolving rake arm acting as part of the regular reel. This was the foundation of the famous McCormick self-rake reaper introduced two years later.

The reaper came to full maturity in the trying times of the Civil War. Women, old men, and children could operate a reaper and get in the harvest, despite the absence of the men who had gone into the Union armies. The commissioner of agriculture estimated in 1862 that it would have been impossible to harvest the crop of wheat if it had not been for the reapers in service in the west, each of which released five men for service in the army.

Parenthetically, it may be noted that the social influence of the reaper was not limited to its usefulness as a man-power substitute in war. William H. Seward once stated that in his opinion the McCormick reaper had extended the American frontier

Below left: The forge shop on the McCormick farm, Walnut Grove, Virginia, as it appeared in 1831 when Cyrus Hall McCormick invented the reaper. This shop still stands.

Below right: Cyrus Hall McCormick (1809-1884), inventor of the world's first successful reaper and founder of the harvesting machine industry.

westward at the rate of 30 miles a year.

Meanwhile the reaper had been changing. The mowing machine, necessarily somewhat similar in design, had evolved early as a separate type, following the Hussey tradition. By 1849 McCormick had produced a mowing attachment for his reaper. In 1865 he began to build a separate mower.

But the harvesting machine industry was about to be revolutionized anew by the work of two young farmers of DeKalb, Illinois, C. W. and W. W. Marsh. Their first patent on the Marsh harvester was obtained in 1858, but not until 1863 was their machine in the field for sale. Its effect was instantaneous.

The Marsh machine, like all reaping machinery since 1831, was founded on the McCormick principles of cutting the grain. But it took a long step forward from that operation. As the grain was cut with a Marsh harvester, a moving canvas carried it over the drive wheel from the knife platform to a binding table. Behind this table was a platform on which two men could ride standing erect. They seized the grain as it came up and tied it into bundles, dropping the bundles on the ground.

The Marsh brothers' theory was that the necessity for collecting and binding grain on the ground, where it had fallen from the reaper platform made harvesting too slow and laborious. The Marsh machine speeded up the work, since the binders rode standing erect and did not have to stoop and step along, scraping together armloads of wheat and halting to tie it.

This was the second major advance from the original reaper. The first, the self-rake reaper, had eliminated the man with the rake. The Marsh harvester cut the time required for binding, in two. This was by no means the end of mechanical development. More was to come, and came speedily.

With the Marsh harvester as a working basis, Sylvanus D. Locke of Janesville, Wisconsin, developed and patented in 1871 a self-binding device which used wire to tie the bundles. James F. and John H. Gordon of Rochester, N. Y., produced a similar machine. At practically the same time Charles B. Withington of Janesville, working with the McCormick people, produced a very simple wire-binding attachment which was patented in 1872. The McCormick firm began immediate production and sold more than 50,000 machines of the type between 1877 and 1885.

The wire binder eliminated hand tying of bundles. But its own day was brief. Although it had been received with great enthusiasm by farmers, they soon began to complain. The wire, they said, became mingled with the straw and was eaten by livestock, with dangerous results. Still, the wire binder, with two men to shock the sheaves, could harvest twelve or fourteen acres of wheat a day.

The answer to these complaints was not long delayed. As early as 1858 John F. Appleby of DePere, Wisconsin, had invented a successful twine knotter, which he subsequently put aside to devote his time to wire binders. In 1875 Appleby turned again to the twine device. He was successful, and when machines incorporating his invention came into full production in 1880, the wire binder was doomed.

The essential principles of the Appleby binder were first, the elevation and then the downward delivery of the stream of grain; second, packer cranks to wedge the grain against the tying needle; third, the knotting de-

Below left: The McCormick harvester of the Marsh type built from 1875 to 1881. The two men on the platform are binding grain by hand as it is delivered to them by the elevator.

Below right: McCormick's harvester and wire binder of 1876 at work. This was the first practical self binder ever built.

vice itself; and fourth, the automatic trip, to start the mechanism of the binder under the pressure of the weight of grain.

This last development concluded the evolution of the pure reaper, whose only function was the cutting and stacking of grain. Since 1882 all successful grain binders have been built on the same principle. That general pattern is the Appleby binding attachment on the Marsh harvester, with the whole machine founded on the McCormick reaper frame and cutting mechanism.

Improvements in detail have given each manufacturer a slightly different machine. Steel construction instead of wood, anti-friction bearings, tractor power drive, and other modern contributions have been made, but the twine binder of today is in essence the machine of 50 years ago.

But if the twine binder could not be improved upon in its work, it could be and is being progressively superseded by a machine, its lineal descendant, which goes beyond the operation of cutting and tying grain, and undertakes successfully to thresh the grain as well and to deliver it ready for market in one continuous operation from cutting to bagging. This machine is the harvester-thresher, or combine. It is the most spectacular instrument of modern power farming, the child of a marriage between the binder and the old stationary threshing machine.

The combine has come into glory only recently. Yet it is a very old machine. There were some attempts to achieve a combine even before Cyrus McCormick perfected the reaper. One machine, developed only five years after the reaper, by H. Moore and J. Hascall of Kalamazoo, Michigan, actually worked. In 1838, in a test, it cut, threshed, cleaned, and bagged 1,100 bushels of wheat in one day. Judged by modern standards it was a crude and unwieldy affair. A few were sold, but generally they were too expensive and not well adapted to the climatic and grain conditions of Michigan.

The harvester-thresher really bloomed on the Pacific Coast. In 1853 one of the Moore and Hascall machines was shipped by water around Cape Horn to California. In the harvest of 1854 it cut 600 acres of wheat in Alameda County. Conditions in California were ideal. Rain seldom fell in the harvesting season, and the grain ripened evenly with the straw standing stiff and upright. Land was cheap, and wheat was grown on a very large scale. By the '80s and '90s of the last century, the building of harvester-threshers was an industry on the Pacific Coast, with a dozen or more small companies engaged.

These were huge machines, the smaller ones requiring 18 to 24 horses to pull them and the larger models needing 40 to 50. Sometimes they

The McCormick-Deering tractor binder being operated with a Farmall tractor through a power take-off from the rear of the tractor which makes the binder independent of ground conditions and enables it to operate where a horse-drawn binder would find it difficult to cut the grain.

were drawn by great steam tractors.

It was plain that the size and weight of these machines must be greatly reduced if they were to be introduced to the smaller farms of the central west and the east. As early as 1904 International Harvester engineers were studying this problem. The company successfully pioneered in the field of the "small" combine, or harvester-thresher, which meant in those days a machine that took a cut less than 16 feet wide. Much experimental work was done in 1911, 1912, and 1913, and the company placed its first harvester-thresher in factory production in 1914.

The modern combine contains all the essential principles of the original reaper. It has a reciprocating knife, guards in front of the blade, a reel, a platform, a main wheel, the principle of draft from one side of the implement, and the divider of the grain. The combine of today gets its power not from ground traction through the main wheel, but from the tractor by a power take-off or from a stationary engine mounted on the combine itself. That, however, is not a new principle of mechanics, but merely the adaptation of a system of propulsion not yet dreamed of when McCormick built the reaper.

In addition to these reaper principles, the combine contains the essential principles of a threshing machine. These are: 1. A feeding mechanism to take the grain from the cutting platform up into the threshing mechanism. 2. A cylinder, either of the rub-bar, spike-tooth, angle bar or other type, to separate the kernel from the head of the grain. 3. Straw-walkers or racks, which shake the grain to separate the kernels from the straw. 4. A fan which blows the lighter parts away from the kernels. This is done by a sieve and blast arrangement based on area and weight of the material handled. Chaff is big and light. The kernels are comparatively small and heavy. 5. A return mechanism which sends back to the cylinder any unthreshed heads which have passed through the machine.

The winnowed grain is either bagged or poured into a tank, from which it can be poured directly into a motor truck alongside the combine. The straw is ejected at the rear of the machine, either in windrows for later baling or dispersed by a scattering attachment to lie on the ground and be plowed under as fertilizer.

The engineering attack on the problems of the combine is by no means ended. It is still a rapidly changing machine. The tendency is toward smaller and lighter models, to be used with smaller tractors, the whole tractor and combine rig being operated by one man. The width of the combine cut, on machines used east of the Rocky Mountains has been reduced from sixteen feet or more to twelve, to ten, to eight, to six feet.

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McCormick-Deering harvester thresher. One of the large, modern types of grain harvesting machine capable of cutting from 40 to 50 acres a day, threshing grain and delivering it, after a thorough cleaning, into a grain tank seen directly above the head of the driver of the tractor.

WORLD'S FAIRS STIMULATE PROGRESS IN LIGHTING

By
Floyd Brown

STIMULATED by the New York and San Francisco World's Fairs, lighting engineers have once again brought the future to the present. Because of these two events, many spectacular new colored lighting effects may be available for public use nearly ten years ahead of the time when they would be commonly used under ordinary circumstances.

Many of the developments are already finding applications for safer highway and street lighting or for better lighting of architectural interiors and exteriors. The short-arc mercury lamp developed to bathe the Perisphere and Theme Center at the New York Fair in a striking blue light has already found another use as an improvement over present-day city, street, and parkway lighting. This improvement in exterior lighting is matched in interior illumination by the new "downlight," which paints a modernistic pattern in color on the ceiling of a room and shines white on the people below.

The challenge provided by the spectacular effects necessary for the success of such an exposition has always been met by illuminating and applied lighting experts. Looking back over past fairs, we may observe that each one has encouraged improvement in lighting conditions for the average American home, and has provided spectacular displays to advertise improved lighting.

Long before gas was widely used as an illuminating method for outdoor displays, the Philadelphia Centennial Exposition of 1876 was brilliantly decked out with gas lamps—truly a marvelous improvement over smoky, flickering oil lamps. Thus more than sixty years ago, the public was made aware of a new lighting method by one of these great fairs.

The World Columbian Exposition held at Chicago in 1893 served to bring forth our modern lighting sources. Previous to this Fair, all electric lighting had been done by direct current except for two experimental alternating current systems—one at Great Barrington, Massachusetts, and the other at Buffalo, New York.

Realizing the limitations of the direct current system, Mr. George Westinghouse had started the development of apparatus by which alternating current could be generated, transmitted at high voltages, and then transformed back to pressures suitable for lighting and power purposes.

When bids were requested for lighting the Columbian Exposition, Mr. Westinghouse proposed this new revolutionary method and was awarded the contract. More than 250,000 electric lamp bulbs had to be manufactured, and the machinery necessary to furnish current had to be built, installed, and maintained during the time of the Fair. The installation was a great success, and the illumination of the Exposition became an internationally famous spectacle.

Forty years later, the Century of Progress Exposition in Chicago served to introduce to the public many new decorative colored lighting effects and the external use of tubular lights for both day and night. The now common mercury vapor lamps also date their popularity from that occasion.

From this past experience it seems safe to assume that the marvels of this year's World's Fairs will be rapidly adopted all over the country. The new effects achieved this year in fountain and tree lighting, underwater illumination, "black light," and fluorescent tubular lamps should soon find common use throughout the country.

Many of these new effects are used on the five major illumination projects on Constitution Mall of the New York World's Fair. These lighting spectacles include the Lagoon of Nations Fountain, the Perisphere at the Theme Center, the Court of Peace, the Federal Building, and the Meadow Lake. They were designed by the Fair's lighting consultants, Bassett Jones and the firm of Morgan, Hamel & Engelken. Special equipment for four of these beautiful displays was being rushed to completion by the Lighting Division of the Westinghouse Electric & Manufacturing Company.

To obtain such brilliant illumination of these five major projects more than two and a quarter million watts of electric power will be used each hour. This is more than enough electricity to light a highway from Norfolk, Va. to the Fair site.

The master spectacle of the Fair will be the Lagoon of Nations Fountain. This elaborate exhibit is said to surpass any previous effort of its kind in size, beauty, and elaborate design. From the center of a pool, 700 by 400 feet in size, cascading jets of water will spurt 160 feet into the air to trace myriad patterns upon the sky. From the nozzles of this fountain more than 20 tons of water will be flung into the air at a time.

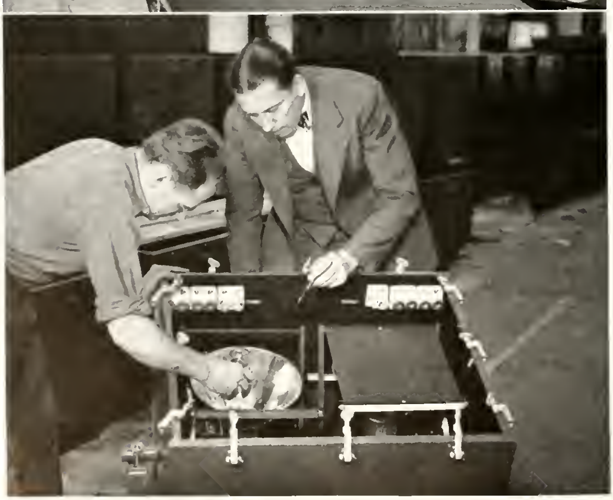
To illuminate the fountain, a maze of 585 twin-light projector units will produce a panorama of color through the entire range of the spectrum. The units rest almost entirely under water on a man-made island near the center of the Lagoon. The projectors will blend their beams with the water jets in a series of versatile color combinations.

Each of the 585 waterproof units will contain a 400-watt mercury arc lamp and a 1500-watt Mazda lamp. Each lamp has a hexagonal vari-col-

Upper right: A typical application of the flush-ceiling "downlight." Units have been installed in the marquee of the Hall of Industrial Science.

Lower right: The 120 foot Singing Tower of Light is the scene of a display of smoke, water, colored lights, and fireworks, all synchronized to music.


NGHOUSE



ored glass filter or colorwheel revolving above it. Each color wheel is rotated at a speed of one revolution per minute by a small, three-phase synchronous motor and can be made to rotate in either direction by remote control from a master switchboard atop a nearby building.

Thus, the ever changing color filters with panels ranging from red, pink, amber, canary, and green to light and dark blues, will make possible a great variety of pastel color effects. In addition to this base lighting the very top of the highest jets of water in the fountain will be illuminated by 12 searchlights located at intervals around the Lagoon. Each of these auxiliary units will use a 2,200-watt lamp.

To give a semblance of living light to the Perisphere, which with the Trylon makes up the Theme Center at the Fair, Westinghouse technicians built 30 special projection units which will envelop the massive sphere in a striking blue color. Each of these new projector units contains a series of nine 400-watt mercury lamps and is equipped with special 8-inch Fresnel lenses.

Another battery of 40 narrow-beam projectors with Fresnel lenses and using 5 000-watt lamps will be directed upon the Perisphere from another angle. Red and amber color filters will be used on these units to obtain the appearance of clouds floating across the surface of the giant sphere.

Another of the major projects, the Court of Peace, will be blanketed by a canopy of light from 16 searchlights mounted atop the Hall of Nations. This battery of lights will shoot high-intensity beams above the Court at an angle of 45 degrees to form a veritable pyramid of light to cover an area of more than 200,000 square feet.

To obtain this new effect, Westinghouse engineers devised a 1,000-watt capillary mercury lamp of such intense power that a gallon of water

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Top: Installation of twin projector units in one of the three rings for the symphony of light, water, and sound.

Center: A new 400-watt high pressure capillary lamp being placed in the floodlight unit.

Bottom: Final test of the color-drum units to be used in the water show.

ENGINEERING PREPARES THE NATION'S DESSERT

By

Philip D. Sang

OF all American delicacies, none is more popular than ice cream. In recent years it has become more than a luxury and is now included in most daily menus, being highly recommended by dieticians.

Because of the complicated process of manufacture, ice cream making has become the problem of the engineer. Let us follow the path of production of our National dessert through the plant of one of Chicago's large ice cream manufacturers.

The main ingredients of the ice cream formula are sweet cream, cane sugar, eggs, and flavoring. All dairy products used in the manufacture of ice cream in Chicago are "Grade A", being produced and processed in accordance with regulations specified by the United States Public Health Service and under the local supervision of the Chicago Board of Health.

The milk products are received daily from country plants, being shipped in by refrigerated trucks carrying either tanks or 10-gallon cans. Upon arrival at the ice cream plant, milk and cream are inspected for quality, samples being taken for laboratory tests. The cans are then emptied and the raw product cooled and pumped into one of four 2500-gallon stainless steel tanks. The empty cans are immediately washed and sterilized by steam and dried by a blast of 240 F. air blown into the can at high velocity. In the case of a tank truck, the tank is connected by a pipe line to a sanitary pump and emptied into one of the four holding tanks. All piping is stainless steel, equipped with sanitary connections so that it is easily dismantled for cleaning and sterilizing after each operation. The storage tanks are of the horizontal, cylindrical type, with stainless steel linings, insulated with four inches of cork and protected on the outside by jackets of stainless steel.

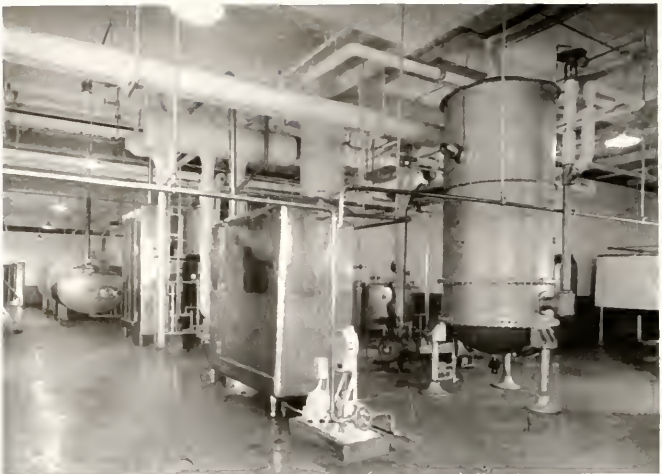
After the milk, cream, and condensed milk have been tested, the necessary proportions of each are calculated for the batch of ice cream to be manufactured. Each of the aforementioned ingredients is then separately pumped into a 2000 gallon mix tank, the flow being measured by a hydrostatic gauge in that tank. Here, sugar and egg yolk are added, and in the case of chocolate ice cream, the chocolate flavor is likewise put in at this point. These products are all thoroughly mixed by two large propellor agitators and the mixture obtained is known as ice cream mix.

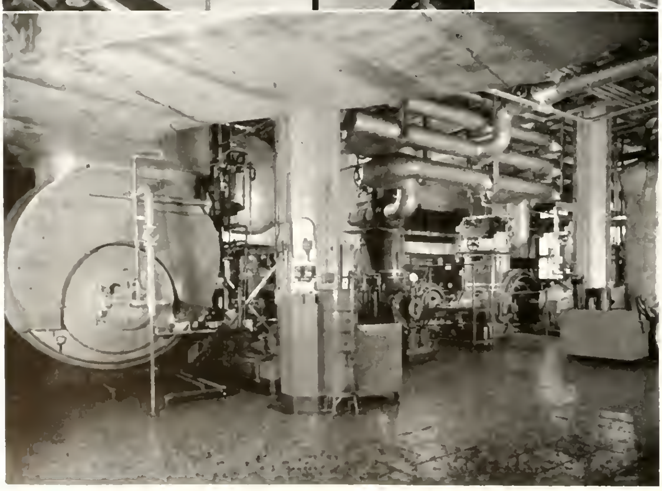
From this tank, the mix is pumped through a filter to a stainless steel vertical heater, where its temperature is raised to 160 F. The heater is constructed of four sections of seventy-two 1″ diameter tubes, mounted one above the other in a vertical plane. The ice cream mix is distributed at the top of each of these four sections of tubes simultaneously and permitted by gravity to flow down over the outside of them in a thin film. Hot water is circulated through the inside of the tubes, the hot water entering at the bottom and leaving at the top, so that the mix is heated gradually. The water temperature is closely controlled by air-operated temperature controllers so that the mix is neither over nor under-heated. A trough at the bottom of this vertical heater collects the mix as it reaches the bottom of the sections. The heater itself is entirely enclosed with stainless steel covers to prevent any contamination from the outside.

The next process is known as homogenizing, which is accomplished with a high pressure pump. The mix is forced through a series of closely fitted stellite valves at 2500 pounds pressure, the object of this being to break up the fat into very small globules and distribute them uniformly throughout the mix. This helps ultimately to produce a smooth, velvety ice cream. The mix, of course, will remain uniform as the butterfat is broken up into such small particles that the cream will not rise when the mix is allowed to stand. These fat globules are from two to four microns in diameter, a micron being about 1/25000 of an inch.

After being homogenized, the mix passes through the pasteurizer where it is held for thirty minutes at a temperature of 160 F. The pasteurizing tanks have a capacity of 500 gallons. They are constructed of stainless steel with steam jackets to assure constant temperature control. Each tank is equipped with a recording thermometer, and pasteurization charts are carefully filed and sent periodically to the Board of Health, where they are checked for time and temperature. These pasteurizers have close fitting, overlapping covers, and efficient pasteurization is effected by maintaining the temperature of the air space between the top of the mix and the bottom of the cover of the tank at 150° F. to prevent any possible contamination of the product.

After being held for thirty minutes at 160 F. the mix is quickly cooled to 32° F. by flowing over a vertical cooler of the same type as the vertical mix heater, with the process reversed. Cold water flows through the upper half of the tubes and ammonia is circulated through the lower half. The ammonia circulates from a surge tank above the cooler in which the temperature is controlled by a pressure regulating valve maintaining approximately 45 pounds pressure so that





Ice cream mixing department. Raw milk and cream storage tanks in the rear, pasteurizing equipment in the center, vacuum pan for condensing at the right, and mix cooler in the left foreground.

Ice cream mix storage tanks and battery of Vogt ice cream freezers in the left background.

Engine room showing one of two 150 H.P. convertible gas or oil fired boilers in the left foreground and section of battery of ammonia compressors.

the temperature of the ammonia will remain above the point where mix will freeze onto the tubes.

The mix is now pumped into one of a series of 1000-gallon mix storage tanks, where samples are taken for testing in our own laboratory. After the tests for butterfat and total solids have been made, the mix is standardized to conform to our requirements and tested again to insure absolute uniformity. Flavors, such as pure vanilla, maple syrup, etc., are added in these tanks and the mix is now ready to be frozen into ice cream. The freezing process must be rapid since slow freezing tends to separate the constituent parts of the mix into ice crystals and in general gives the cream a coarse and unpleasant texture. Thus, the faster the freezing, the better the flavor and texture of the finished product.

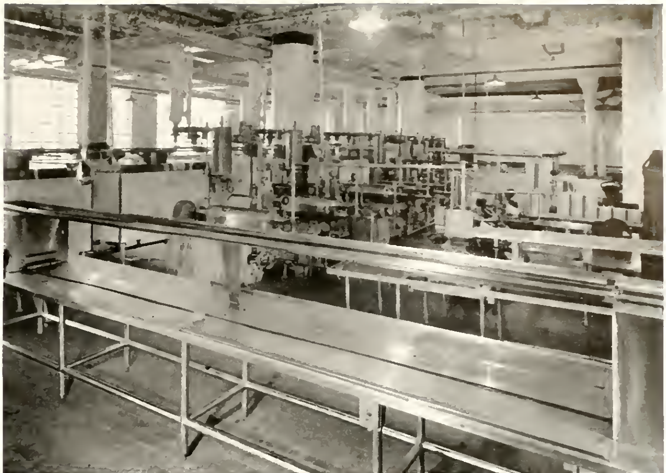
In the company under consideration, instantaneous freezing is achieved by the use of six of the newly developed Vogt freezers. In the Vogt freezer, a stream of liquid mix from the holding tanks is combined with a stream of air and passes into a chamber approximately 42 inches long by 4 inches in diameter. About this chamber is an ammonia jacket in which a temperature of minus 20° to minus 30°F. is constantly maintained. The cream enters this chamber at a pressure of from 80 to 100 pounds per square inch and the mix next to the wall is instantly frozen and then scraped from the wall by rotary knives which pass through the entire length of the chamber. These knives rotate at 600 r.p.m. and force the mix out in a stiffly frozen yet plastic state.

As the ice cream leaves the freezer in its partially frozen state, fruits, nuts, candies, etc., are injected into it. The semi-frozen product is then filled by automatic filling machines into various sized containers ranging from 4 ounce paper cups to 5-gallon paper cans. Six Vogt freezers make up the battery having a total capacity of 1650 gallons of ice cream per hour with filling machines to package at this same rate. The ice cream, of course, after being discharged into the containers is still only partially froze[n]

Vogt ice cream freezers and packaging equipment.

Laboratory, showing equipment used in chemical and bacteriological analyses.

Factory and General Offices of the Goldenrod Ice Cream Company, at 3900 South Michigan Avenue, Chicago.



and the freezing process must continue.

This is accomplished in a hardening room in which a temperature of minus 35°F. is maintained. This temperature is necessary to finish the freezing as rapidly as possible to prevent large ice crystal growth. A constant blast of cold air on the ice cream hastens this process. After being hardened, which requires from 15 minutes to several hours, depending upon the container involved, the ice cream is stored in a chamber having a temperature of minus 20°F. until ready for shipment. The temperature of the hardening and storage rooms is maintained by a circulating ammonia system. These rooms, measuring 80 feet by 100 feet are equipped with 45,000 feet of all-welded 2" pipe.

Refrigeration is furnished by two York booster compressors and four York compressors totaling 300 tons of refrigeration. Steam for processing and heating is furnished by two 150 H.P. Scotch Marine boilers. The boilers are gas fired from April 1st to November 1st and oil fired during the remainder of the year.

The entire ice cream factory and all its equipment have been designed with simplicity of operation as the paramount motive, coupled with the ideal of cleanliness so essentially vital to every food manufacturing plant. Glass blocks have been extensively used to provide for most of the light and prevent in turn the entrance of dust and dirt. The factory is air conditioned and all air filtered before entering. The ice cream manufacturing equipment is constructed for the most part of stainless steel and so designed that it can be easily dismantled for cleaning. Every machine, pipe line and utensil is completely dis-assembled daily, thoroughly washed and sterilized. After re-assembling and before being used again, a disinfecting solution is circulated through every piece of equipment. Stainless steel tables, equipped with stainless steel belts are used for packaging the smaller items such as big tops, ice cream bars, popsicles, etc.

In the laboratory, equipment is provided for completely analyzing all products used in the manufacture of ice cream. Milk products and ice cream are tested for butterfat by the

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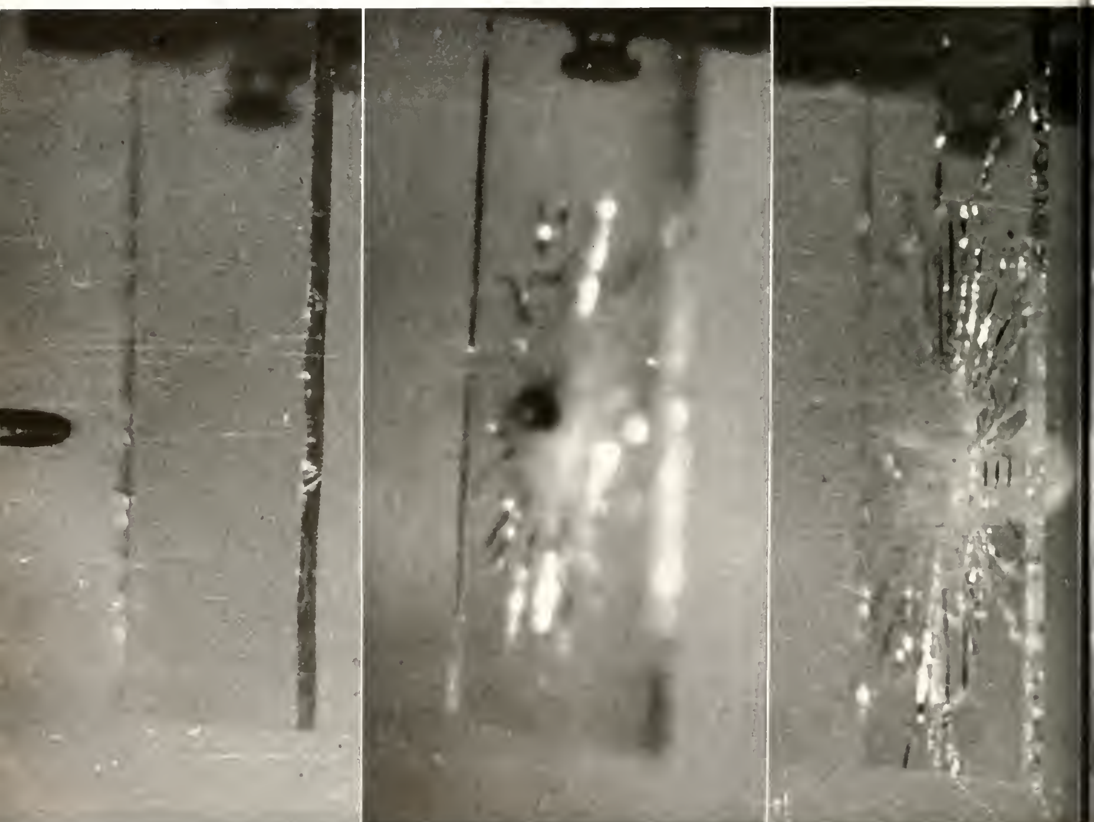
PHOTOGRAPHY IN

AN even hundred years ago photography was born. Because it was raised entirely on a diet of research from the very first, we can look back in the present year upon what is truly a "century of progress." Science, of course, looks back only to get its bearings, for there are more valuable things ahead.

For a portrait photograph in 1840, the subject, attired in white clothing and with the face liberally coated with white powder, sat rigidly still for ten minutes or more in the most glaring sunlight. The treasured result was not quite so good as some of the things that the modern amateur throws into his darkroom waste basket. The early photographer was of necessity a research worker. He felt rewarded if his efforts yielded an image of any kind, and he was not inclined to be choosy about his subjects. Lenses were slow. The photographic plates—film was unknown—were slow beyond belief, sensitive only to limited regions of the spectrum, and awkward to handle. Lighting facilities were so limited that, in general, only the brightest sunlight was worth considering. Taken as a whole, the early photograph was a scientific marvel. As with a trained seal, the marvel was not that it performed well, but that it performed at all.

Today, more than ever, research is being directed toward new and better photographic processes. In its hundred years of development, however, photography has satisfied the requirements of Lord Kelvin's criterion of a true science. With this it has become a most valuable research tool itself, broadening the scope of investigations in countless fields and yielding much information which was once extremely difficult or even impossible to obtain. Simultaneously, it has taken its place in the front ranks as an efficient method of recording and preserving information, and by doing so has made available for other uses much of the investigator's time.

A series of photographs showing what happens when a bullet strikes a pane of glass: 1. The bullet is about to strike; 2. The bullet has entered the glass, and cracks are appearing in the glass; 3. The bullet has just passed through the glass; 4. With the glass still standing, the bullet emerges in a cloud of powdered glass; 5. The bullet has already gone on its way, and the glass finally gets around to shattering.



RESEARCH

By
F. W. Godwin

Were a visitor to go through the laboratories of an organization such as the Research Foundation of Armour Institute of Technology with specific intention of noting the applications of photography to industrial research, he would be impressed. Here under one roof the many diversified problems at one time or another involve every existing type of photographic process, and on occasion demand new ones which must be devised on the spot.

First of all, there are the ordinary routine pictures. A member of the research staff has just returned from a distant factory where he has been studying a large piece of machinery in need of redesigning, and his miniature camera contains photographs of certain portions of the mechanism which must be examined further in the laboratory. Another staff member must have a quick copy of an elaborate diagram or perhaps a set of laboratory data. Still another is preparing a report in which he intends to include such photographs as are necessary to show how the particular experiments were conducted. Meanwhile, in one of the laboratories a number of samples of various materials are being subjected to a test, after which they will be photographed side by side to show their comparative behavior under the test conditions.

While the routine photographs are made with ordinary cameras, many of the laboratories must use highly-specialized equipment in the gathering of research data. In the X-ray Laboratory, information on crystal structure is obtained by means of diffraction patterns recorded in specially built rotating cylindrical cameras. Another X-ray unit provides for visual or photographic study of the internal construction of articles, and for the location of blow-holes and other flaws in test pieces. Rapid chemical analysis is accomplished with the spectrograph, and this instrument is used also in determining the character of the light emitted by a lamp. In another

Extreme right: The fastest bullet on the market, the 220-Swift, photographed at the world's fastest exposure of less than one millionth of a second. Taken with the aid of V. G. Leach, sportsman, f8 on Agfa Ultraspeed Pan, in the Research Laboratories of Armour Institute of Technology.

device the finished spectrograph plate passes under a photoelectric cell which causes an automatic recording of its intensity curve on a thirty foot film.

The photographic trace of the seismograph is much too useful to be confined to earthquakes. In the Research Foundation, a seismograph capable of making six simultaneous records is used frequently in studying large and small vibrations and impacts, the behavior of household appliances, the scratching tendencies of writing implements, and many other phenomena. For work of this kind, the oscillograph is used also, providing a picture of the wave forms of sound and vibrations, the frequency of impacts, and so on, which are of great value in studies directed toward the quieting of machine noises.

For some purposes, with either ordinary or special cameras, it may be necessary to resort to such aids as filter combinations, infra-red, ultra-violet and polarized light, direct-positives, image reversal, double exposure, and anything else that is necessary to give the desired research information. With polarized light, for example, the photoelastic apparatus yields pictures which show quite plainly where the strains are concentrated in a loaded structural member, how and where the piece will eventually break, and what to do about its design to prevent the failure.

Many investigations call for photomicrographs. These greatly enlarged photographs of what the eye sees—and sometimes what the eye cannot see—in the microscope increase the utility of that instrument, and in addition furnish a permanent, accurate record for ready reference at a later date. It is not feasible for the investigator to examine simultaneously a hundred nearly identical samples under the microscope, but when a hundred photomicrographs are arranged systematically in front of him, the small differences which he may be seeking become clearly apparent. The condition of fine fibres, minute grain structure, surface conditions, and flaws in industrial finishes can be photographed and studied in detail at the research conference table. In some cases, the sample under the microscope may be undergoing rapid change, so that only by a photograph can the process be arrested long enough for proper examination.

Ordinary motion pictures provide a true record of the order of a sequence of events, if such a record seems necessary. Thus an experiment which occupies only a few minutes but which requires considerable preparation may be photographed so that it may be reviewed later rather than repeated; so also with a test demanding the simultaneous reading of numerous dials on a control panel.

Many industrial operations take place so quickly that they cannot be followed by the eye or the normal-speed motion picture camera. These operations, involving as they do terrific forces, high rotational speeds, sudden starts and stops, and rapid distortions, are naturally sources of trouble unless properly carried out. The design of machine parts and other objects involving high speeds requires studies in which the motion is instantaneously arrested or else slowed down for observation. If the machine itself is slowed or stopped, the condition causing the trouble ceases to exist and the study cannot be made; hence, examination must be made with operation proceeding at full speed. Some cyclic operations may be observed visually by means of the stroboscope, but this valuable instrument has its limitations, for while the satisfactory performance of a machine may be cyclic, its failure is not. High speed photographic methods are necessary in such cases.

The high speed photography employed in industrial research problems falls into two types. For following the action of reasonably rapid objects, a special motion picture camera taking several thousand pictures per second is very satisfactory and yields a film which can be projected at normal speed to give a slow-motion effect. For the most rapid motions, even more speed is necessary, and for these the Research Foundation employs an apparatus of its own recent design which makes exposures of less than one-millionth of a second. These photographs, some examples of which are shown, are made with an ordinary camera aided by an electrical discharge in a partial vacuum and a simple but accurate timing device.

Perhaps the shortening of the necessary exposure time may serve as an index of the advancement of photography. If this is true, it is interesting to note that the 1840 portrait mentioned at the beginning of this article required an exposure more than six hundred million times as long as that of the illustrations shown here.

A high speed grinding wheel, photographed while turning at 25,000 revolutions per minute.

DETECTION OF FISSURES IN STEEL RAILS

By
C. W. Gennet, Jr.

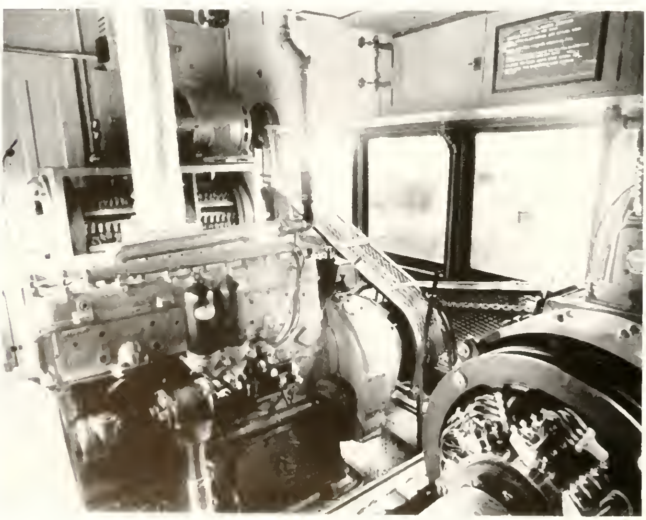
The complete Sperry Detector Car which houses all the equipment necessary for the detection of fissures.

THE testing of steel rails in track for the purpose of locating internal and concealed defects was regarded as impracticable, if not impossible, until 1927, when Dr. Elmer A. Sperry invented a method employed by what are now commonly termed Sperry Detector Cars. In scarcely ten years' time a new and remarkable procedure has been built up whereby the most insidious form of rail defect, known as "transverse fissures," can be definitely located in the tracks, with the result that the hazardous rail can be promptly removed from service. In that ten years' interval well over half a million miles of track have been tested and, estimating conservatively, something close to one hundred thousand fissured rails have been found. Obviously the march of progress in this direction, as in many others, has been fast and fortunate, for the much higher train speeds of the last few years have created a demand for safe tracks and transportation that, except for the Detector Car, railroads might have found it difficult, if not very expensive, to provide.

While transverse fissures are fairly well known to those intimately connected with railroads, it seems appropriate to review briefly some of the facts concerning them. They are, as shown on page 21, of entirely internal origin, always occurring in the head, or ball, of the rails, and regarded as having their conception in a nucleus generally located one-half to three-quarters of an inch beneath the running surface. These fissures are distinctly an internal crack which grows or develops from the nucleus. In all probability the nucleus is present in the rail when it leaves the rolling mill and must constitute a minute rupture in the crystalline structure of the steel. Its cause is uncertain, but many aver that it is due to strains and stresses set up in the rail as it cools from the rolling temperature. Under traffic the nucleus evidently begins to grow or develop into the cracks. That this growth is of progressive character, and therefore a function of time and traffic, is clearly proved by the rings shown on page 21. Under continued traffic the fissure may grow to the surface, and the consequent admission of air oxidizes the surfaces; otherwise, as when found by a Detector Car and broken, the surfaces are bright and smooth. Fissures have been found in rails made of practically all common kinds of steel, and found in rails laid on all kinds of ballast, in tunnels and on bridges, as well as on curves and tangent track. In short, no rails have appeared im-

Upper: The recording compartment is located in the rear of the car. Note the tape which automatically charts all rails tested.

Lower: Interior of the generating compartment of a Sperry Detector Car.



mune from the development of fissures, and so many points of similarity exist that they have been frequently referred to as rail cancers.

The principle employed for the detection of these fissures has repeatedly been described, but very briefly it consists of the setting up of a strong magnetic field in a length of three or four feet of the rail. This is accomplished by putting approximately 3,000 amperes through the rail by means of brushes, shown on page 21, and which bear or sweep on the head, and which can be raised or lowered at the will of the operator. About midway between these brushes is the detector, or sled, as it is frequently called, and which of course contains a number of small coils of fine wire. Obviously the magnetic field set up in the rail is uniform in character, but the imposition of some impediment, such as a fissure or other defect, causes a distortion of the field which is picked up, so to speak, by the coils of the sled. Such reaction in the coils is amplified and by means of relays sufficiently enlarged to operate recording pens on the Detector Car tape or paper, as well as to set off a paint gun which shoots a small daub of paint on the rail at the location of the defect.

While all this appears simple enough, the matter of carrying out the detail on a car as it is travelling along the railroad tracks requires a highly complicated lot of machinery, some of which is necessarily delicate and sensitive and demands almost constant attention and maintenance. Thus, apart from the Diesel driven engine and generator, with the traction motors and air brakes used for propelling the modern Detector Car sixty feet long and weighing 130,000 pounds, all of the attendant Sperry equipment must be housed on the same car, with living quarters provided as well for the four or five men comprising the crew. A six-cylinder gasoline motor is used for driving the generator to provide the current used in energizing the rails. An air compressor furnishes means for quickly raising and lowering the brushes, also an agitator for the paint system used in marking the rails; and equipment for lighting and heating are among the requisites in the so-called power plant of the modern Detector Car. The amplifier, relays, and recording mechanism are located in the operator's room at the rear end of the car, where he can sit with an unobstructed view of the rails.

It seems unnecessary to repeat here the many explanations of "how the car works." It is sufficient to say that when the operator announces a fissure

one had better not make any bet to the contrary. Time and time again such calls have been tested, and the unfailing accuracy of finding a fissure at the exact location specified in the rail and of a size determined as well is no longer a matter of question or dispute. The problems of ten years' experience have been in other directions and of a kind that have made constant research and experiment in both laboratory and field an important attribute of ordinary operations.

The results of this research have been of great benefit from many different angles, so that undoubtedly the detection of various types of defects has been rendered much more accurate, while also enabling the car to cover nearly twice the distance per day that it originally did. Testing from twenty-five to thirty miles of track per day is not unusual now, whereas the detection of smaller sized fissures, and perhaps some of the larger ones as well, has probably been rendered more certain.

The original sleds contained but two coils, and it was soon found expedient to devise sleds with multiple and tandem arranged coils, thus insuring the covering of a larger area of the rail head than otherwise. Some fissures appear to be located on one side of the rail, while others are on the other side, and of course many in between. Unless there is great care taken in the positioning of the sled and coils it would be naturally easy to miss certain fissures, and the great advance made by use of multi-tandem coils has very greatly improved the efficiency in this direction.

Very early in the operation of the car it was found that various fissures registered on the Detector Car tape more conspicuously when the car was making a repeat run over the particular rail. In short, it appeared that a sort of double energizing of the rail —that is, the setting up of two magnetic fields in sequence, was perhaps desirable. Continued experiments and a great deal of research along these lines resulted in the adoption of a system of "pre-energizing," which has been one of the outstanding improvements made. This pre-energizing requires an additional but smaller sized generator and the addition to the car of two extra brushes, so placed on the rail that they are ahead of the main brushes previously referred to. Thus a strong magnetic field is set up in the rail between the first set of brushes, and this is immediately followed by the creation of an even stronger field resulting from the second set or main brushes. Peculiarly, but without question, this double energizing has been of marked advantage.

Another improvement of seemingly small significance, but after all of great importance, has been the adoption of a paint system which would actuate a paint gun so quickly that a very small daub was put on the rail, so timed as to insure the accurate locating of the fissure. As originally designed, the paint system and gun left a considerable paint mark on the rail, frequently of a foot or so in length, rendering some question as to the accurate locating of the fissure. The new system actuates instantaneously with the relays and as the daub is of very small proportions accurate locating is greatly enhanced.

Progress has also been made in the locating of fissures near the angle bars or joints holding the two rails together. Obviously these joints distort the magnetic field to a wide extent, and the testing for fissures in the length of rail contained in the angle bar zone is virtually impossible. However, cars are now able frequently to locate the fissure within a few inches of the ends of the angle bars, and as time goes on it is definitely expected that further improvement in this direction will be made.

As may be readily observed from the above, it frequently becomes necessary for the operator to decide the particular cause for the indication on the tape and the paint mark, for naturally there are many reasons for a distortion of the magnetic field apart from the occurrence of internal defects. Bad cases of engine-burned

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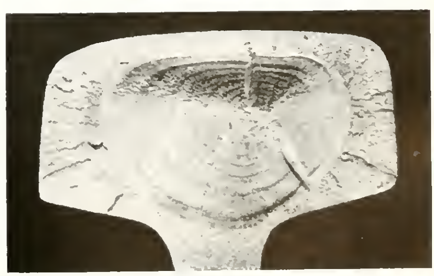
Left: After a flaw is located, a hand test is made to learn its extent.

Right: Two typical views of fissures: the lower one would have broken in a very short time.



THE STUDENT IN PRESENT SOCIETY

By
William Hammer

In the following, I am chiefly interested in the position of the student within society. In choosing this specific section I have not overlooked questions of contemporary importance, such as unemployment of graduates, the frequently unjustified demand for academic degrees, and the overcrowded institutions of higher learning.

Whoever has studied the history of education and society of the past centuries will have noticed that considerable changes have taken place. From the earliest beginnings, an institution of higher learning was the nurturing soil of scholarship and scientific pursuit; in other words, it cultivated a close connection between research and teaching. In the very oldest academies of the Greek philosophers the chief object was *knowledge by means of reason.* The universities during the Middle Ages and the Renaissance, no less than those founded one or two centuries ago, or the leading universities established in more recent times, adhered strictly to this educational aim. The old academies developed relatively high standards and enjoyed high respect; the students' existence pursued quite a harmonious course (although they were not free from material distress), and the chief aim of learning, i.e. to use and to perfect the intellectual tool called reason, was hardly questioned. Both higher institutions and student bodies will lose their internal power and their right to exist as soon as they surrender to other aims and other tasks. Once this seemed to be a matter of course; it no longer is, since in various parts of the world institutions primarily destined for the training of the intellect are made subservient to ends entirely alien to their mission. Colleges and universities may be transformed into political, militaristic, denominational, and commercial training schools; the Oriental and Occidental tradition of more than two thousand years may be overthrown in this or that part of the world; civilization in general and the nation in particular would certainly experience the most violent destruction.

Students in times past who devoted themselves to the pursuit of learning always endeavored to comprehend things rationally. That was what the educational institutions were for. Learning and communicating tricks towards practical undertakings did not pertain to their sphere. Training of the intellect and an actual and solid knowledge had to precede a schooling in professional routine. Here one might raise an objection by pointing to the early professional training of certain groups. To be sure, the mediaeval and the Renaissance universities promoted the schooling of lawyers, teachers, physicians, and clergymen, but even here a thorough training of the thinking capacity and of the power of judgment was put first. This enabled the representatives of the professional schools to see the broad relations between the work of their own and that of other intellectual fields; this enabled them, furthermore, to perform their tasks not just mechanically, but independently by the exercise of their own judgment. Emphasis on the training of mental powers does not imply a neglect of other important factors in life, such as common sense, character, and the sensibilities.

Whence did those young people come who underwent such a training? I will not go into historical details. We may take the emergence of the nineteenth century in Europe as a starting point. The students represented chiefly the upper bourgeoisie. Children of the lower middle class, of workmen, of middle and lower public officials, and of merchants were relatively few in colleges and universities. The upper class men had generally had a university education. The majority of their sons led a life free from financial worries. The students' existence partly bordered upon, partly was isolated from, bourgeois life. These students were independent of and not subject to the authority of supervised boarding establishments (this is also true of the intermediate and advanced students of theology). In fraternity houses they submitted voluntarily to certain rules and thus formed a congenial group within society. The latter did not oppose but respected the young students as the future intellectual leaders of the nation. In the lecture halls, which the students were not forced to visit, there were professors who were scholars and teachers in one person. The fact that these men were not grinds or people who merely reproduced or repeated text books but were research men who had gained their knowledge by long and laborious thinking, was the great stimulus which attracted the intelligent young student. The twofold aim, training of the mind and cultivation of responsibility toward nation and society, was likewise promoted both by the institutions of higher learning and by the students themselves. As a matter of fact, the student's life abounded in contrasts and illusions, but considered as a whole, academic and social activities were well balanced. Up to the pre-war period, student bodies were neither too aristocratic nor too bourgeois-minded; they remained unmolested by class struggles.

This kind of students' status began to be seriously questioned at the beginning of our century. A forceful new element, entirely different in its attitude toward life, not only changed the picture of students and university, but also transformed the notions hitherto current in society about higher learning. This element is the youth movement. The awakening of the youth at the beginning of the twentieth century is noticeable in almost the whole civilized world, but to Europe falls the credit for having organized this movement. The entire struggle now centers around two poles: individuality and community. The young people thought that they were living a life of isolation, that they were not understood by the older generation who taught and ruled them without question and kept them well in leading strings. This conflict between the old and the new generation can be followed throughout man's history; yet seldom has it been so violent as in the last decades. The common opinion of society that children embody the problems of life is counterbalanced by the opposing belief that parents are no less problematic.

From this psychic seclusion a new type of man slowly arose, a type which placed foremost a new mode of life and a new impulse to work *in* and *as* a community. The idea of Liberty assumed a new meaning. In contrast to their fathers who emphasized military strictness in almost everything, these young people fought for new ideals, called attention to their own innate values, stressed an approach to nature, and preferred genuineness and unaffectedness. The new type of youth likes to point out the contrast between itself and the ruling generation. The young students as well as non-students were radical (in the original favorable connotation of the word), unhistorical, they looked toward the future, and disdained tradition unless it were based upon popular customs, songs, literature, and the like. "People" is a very important word in the dictionary of the uprising youth. Together with this goes a better understanding for the socially unprivileged classes and especially the proletariat. We may call this attitude a new social earnestness towering over the remains of ancient feudalism. Pre-war youth did not think of peoples as national antagonists, as is frequently the case today, but merely of human individuals rooting in a soil calculated to

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ARMOUR TODAY

By

C. A. Tibbals, Dean

Right: Entrance to Main Building of Armour Institute of Technology.

Below: The President, Henry Townley Heald, civil engineer, educator, administrator.

MANY people, prospective students, current students, alumni, educated citizens in general, know Armour Institute of Technology in a general way as a standard College of Engineering which has been for forty-seven years training and turning out energetic young men for industry and citizenship. How successfully this training has been done has been revealed by a recent survey of the present status of Armour alumni through its history—an inspiring story.

The visitor to Armour today receives a first, quick impression of a squalid neighborhood, old (not ancient and interesting, just *old*) buildings, dingy from the smoke of railroad and industry, and nothing new. The visiting alumnus says to himself, as his eyes take in "Main," "Machinery Hall," "Mission," "Gas Lab," "Ice Lab," "Flats"—"same old place, nothing new." But as he comes nearer, actually green grass appears, shrubs and young trees soften the hard contours of the buildings. As he steps in the door of "Main," the splendid memorial window still faces him, but he is struck by a new appearance and feeling of well being and of dignity which he finds throughout the building. Across Federal Street is the old Mission, first of Armour buildings, but with a fine new entrance facing West. Entering this doorway, the visitor finds that the old and familiar has been completely replaced by the new—that the old Mission with its miscellaneous assortment of bookstore, lunch room, class rooms, drafting rooms, dingy auditorium flanked by makeshift classrooms, has been transformed into the Student Union. On the ground floor he finds a modern supply store, a spacious dining hall with tables for 300 at once, two small dining rooms for faculty and guests, and an efficient coat room. On the floor above is the Auditorium, but quite unrecognizable. The floor is level from wall to wall, finding frequent use for dances. Under the balcony are massive tables, splendidly lighted, and comfortable chairs for diligent students. A thousand may be seated when the central floor is filled with movable chairs. The old classrooms on the northeast and northwest corners are meeting rooms for student organizations—in constant use. Quarters for musical and dramatic clubs are provided, and an office for the building manager. Up another floor, the caller finds himself in what was the old "Civil Drafting Room," but what is now a commodious lounge—high in size and completely equipped with deep and comfortable arm chairs and couches, card tables


INSTITUTE

Upper left: The Student Lounge provides an inviting atmosphere for rest and relaxation.

Lower left: A corner of the Study Hall in the Student Union.

Right: The newly remodeled auditorium of the Student Union.

reading tables, and radio. A perfect place for those precious moments when we can, and should, relax and loaf in the midst of busy days. The visitor wonders how all of this big building can be given up to the recreational and social side of student life, and where the academic activities of the old building have gone. If he will direct his steps down Federal Street he will come to the old "Flats" which he may remember as housing a Physics laboratory, a few makeshift classrooms, some rooms for student societies, the Y. M. C. A., and vast unknown areas known as "the flats," still housing tenants. In the first two sections he will find the Physics Building — roomy laboratories, adequately equipped, classrooms, offices, on the first two floors; offices and drafting rooms above. The long stretch of building to the South is now Chapin Hall. Two floors of useful classrooms, and many faculty offices and laboratories of Civil Engineering, water supply, soil mechanics, stresses, more laboratories, offices, and drafting rooms from basement to top floor—classroom space with seats for almost 500 students at once. What of the other block of "Flats" on 33rd Street? In the western entrance, the visitor finds the offices of public relations officers, and alumni association, and the *Armour Engineer and Alumnus*, and across the hall the Placement Department, with offices and conference rooms, through which in the first year of the department's life, many an Armour man has found his first job, or changed his old job for a better one.

All of the building to the East houses the Research Foundation, only three years old, but already completely occupying four stories and the basement as well as the old "Ice Lab." across Dearborn Street, with a great variety of general and special laboratories, wherein scientists in many fields are working upon the research problems of Industry. Chemistry, physics, electricity, acoustics, X-Rays, photography, heat transfer, coal, petroleum, insulation are only some of the laboratories and problems. The staff of the Foundation is a group of scientists and engineers who serve the Institute in varying proportions of their time, both in its instructional program as teachers of undergraduate and post graduate students, and in research. Some of these men could not be obtained by, or held at the Institute, for teaching alone, without the research facilities offered by the Foundation.

A visit to Machinery Hall reveals "shops" that are not mere shops for manual training, but engineering laboratories for machine tool work, founding, and welding, as well as laboratories for Metallurgy.

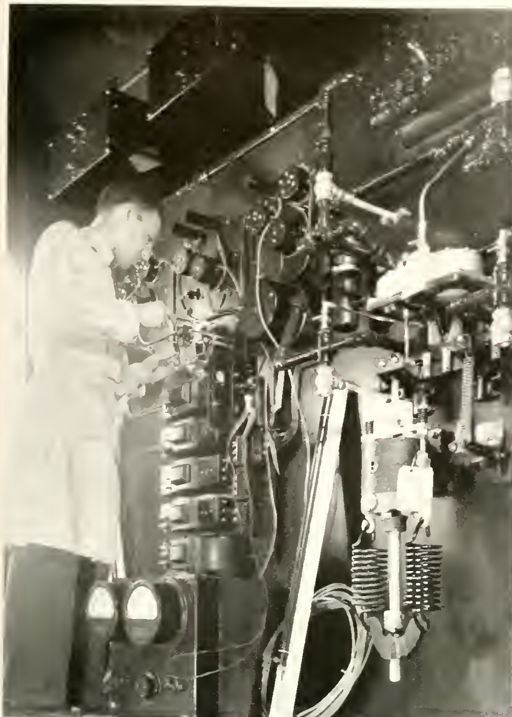
Further inspection of "Main" reveals great extension of chemical laboratories, with increased facilities and modern equipment. Even old Science Hall has been completely remodeled, and now seats over 200, facing west instead of north. The Library has been supplied with modern steel stacks, double-decked, increasing its book capacity 100% without reducing its reading room space.

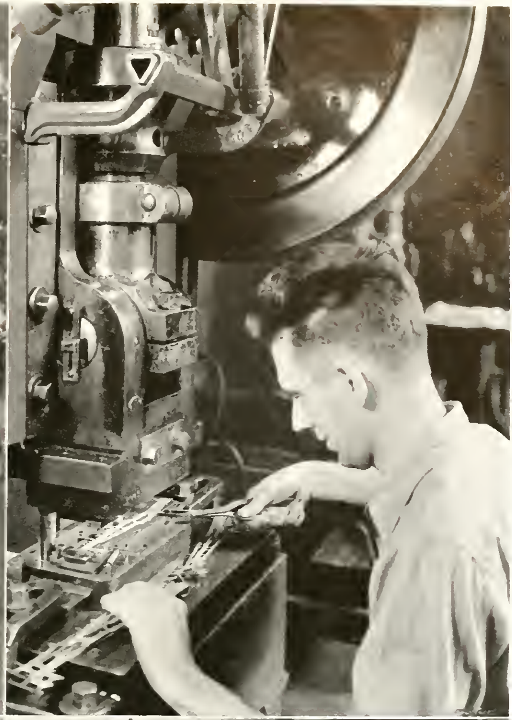
The Entering Student

Each year, for several years, Armour has admitted nearly 400 new students in September, in February,

Left: Dr. Thomas C. Poulter, Scientific Director of the Research Foundation, Chief Scientist and Second in Command of the Byrd Antarctic Expedition II, and recipient of the Congressional Medal, discussing research procedure with Professor James C. Peebles, Director of the Insulation Laboratory.

Right: Cooperative Students at work in industrial plants in and around Chicago.





and to the Co-operative Course. What sort of boys are these? First of all, they are in a measure pre-selected, for in order to meet the requirements for admission, they must have followed the *hard* way, and not the easy way through high school, with three years of mathematics and a year each of physics and chemistry, along with the usual requirements for graduation. All have an ambition to be engineers or architects, not simply a casual desire to go, or be sent, to college, but most come from homes of modest means, and many must contribute to their own educational expense by part-time gainful work. Besides meeting the requirements for specific subjects, the prospective student must show a satisfactory quality of high school work, be recommended by his principal, and present himself for a personal interview. In recent times, more candidates apply for admission and are found unqualified, than are finally admitted. Most of these new students find Armour hard, and the going very different from that in high school. Instructors and personnel officers are patient, giving the freshman time for adjustment to the arduous program of studies, and for a realization that preparation for a learned profession requires not only an "urge to know" but a vast amount of hard work in the learning process.

Student Life

The average Armour undergraduate, whether he be "Architect," "Chemical," "Civil," "Electrical," "Fire Protect," or "Mechanical" must plan for about a 54-hour week in classroom, laboratory, drafting room, shop and in preparation. If he progresses well and does this amount of work, or more, or less; fine! If he does not progress well, and does *less*, the answer is obvious. If he does more and still is unsuccessful, then he has the services of the student personnel staff to help him in his methods of work, or to show him that, perhaps, after all his aptitudes should lead him into a life work other than engineering.

In all walks of life it seems that the busy man is the versatile and accomplishing man. Accordingly, the Armour undergraduates, in spite of their heavy program of work, find time and inclination for a great variety of extra-curricular activities in which the percentage of the student body participating is unusually high. In intercollegiate athletics, there are teams in baseball, basketball, track, golf, tennis, swimming, boxing, and wrestling. Intra-mural, touch-football and softball keep the grass worn off the athletic field, and there is inter-class, inter-fraternity and inter-departmental competition in basketball, track, tennis. A flourishing radio club maintains one of the pioneer amateur stations; the camera club,

(Turn to page 47)

Below: A group of students with Ludwig Mies van der Rohe, internationally famous designer and Director of the Architectural Department. The purpose of this Department is to give the student a thorough foundation in the principles underlying architecture, and to develop in him the abilities essential for professional practice.

Right: Armour accepts responsibility for the development of the mental, moral, and physical traits which are essential to broad and enduring success. Coming to us directly from high school, our students are taught through general studies; through science, fundamental and applied; and through courses designed to further social competence and elevate spiritual standards. Close contact with men of learning and culture in the faculty, educational tests, and measurements, physical examinations, remedial reading, academic and personal counsel, sports for the development of teamwork and co-operation—all these are also factors which produce men who are capable of winning the confidence of industrial management at the same time that they earn the respect and loyalty of the workers.

DO YOU WANT A JOB?

OR DO YOU HAVE A JOB FOR SOME ONE TO FILL?

By

John J. Schommer

WITH the industrial pace slowing down and the consequent laying off of men, the Placement Department has felt the unfavorable circumstances by increased requests for jobs from the alumni. In spite of the additional load above normal, very few of our boys are out of work. The department has been fortunate in placing the men nearly as quickly as they have been laid off. There are still some splendid jobs listed that involve responsibility and pay from $4000 to $10,000 per annum salary. Look them over and if I have failed to give you a chance, it may be due to your neglect in filing your placement record in this office.

The 1939 class, splendid young men, is on the block. Let me hear some bids! About 30 industrial firms have interviewed these young men and some 10 more will do likewise during the month of May. Many have been hired, but many are waiting for a call. If you hear of some firm in these United States or anywhere else that desores a young engineering graduate, let me in on the secret or you sell 'em an Armour "Tech" lad.

Many jobs are being uncovered for our undergraduates who must earn money during the summer to aid in earning their college expenses. There are hundreds of boys registered for this type of work. If you can aid by giving summer work to an undergraduate student, telegraph or telephone me.

ENGINEERS WANTED

SUPERINTENDENT OF METAL WORKING PLANT: 35-38 years of age. Must be familiar with punchings, screw machine and assembling. Plant employs approximately 300 shop hands. Considerable reorganizing of equipment, control procedures, and operating organization necessary. Preferably graduate M.E. Salary $8000-$10,000. Location: Chicago Metropolitan area. Write A. I. T. Placement Department for details.

MANAGEMENT ENGINEER: 25-30 years of age. Must possess ability to get along with people, and must be able to write clearly and directly. Some experience in accounting, sales work or sales analysis, factory control, and machine shop practice.

OPPORTUNITY for income ranging from $75 to $125 for selling an inexpensive and most necessary tool used in Automobile Service Stations such as all Gasoline Filling Stations, Car Agencies, Tire Shops, Brake Shops, etc. Write A. I. T. Placement Department for details.

ALUMNI BANQUET JUNE 6

THE annual Armour Tech Alumni Banquet will be held June 6, 6:30 P. M. at the Medinah Club of Chicago, 505 North Michigan Avenue.

The Glee Club and orchestra, 100 strong, under the direction of O. Gordon Erickson, will furnish the music.

The speakers of the evening will be Wm. H. Trinkaus, C.E.,'08; Phillip Harrington, E.E.'06; James D. Cunningham, President of the Board of Trustees; and H. T. Heald, President of Armour Institute of TTechnology. he toastmaster will be John J. Schommer, Ch.E.'12.

Wm. H. Trinkaus is Chief Engineer of the Sanitary District of Chicago, and was a famous baseball pitcher in his day. He was a four-letter man, winning his "As" in football, baseball, basketball, and track. He will speak on sewage disposal.

Philip Harrington won his "As" on the baseball team at "Tech" and is now Chief Engineer of Chicago's new subway. His talk will be on "The New Subway."

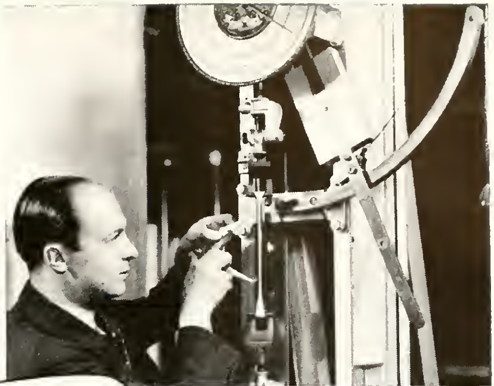
James D. Cunningham, President of the Board of Trustees, will make a short speech on the future of Armour Institute.

H. T. Heald, our President, will speak briefly and answer any questions that may be asked from the floor pertaining to the Institute.

A large number of trustees and members of the faculty will also be present.

John J. Schommer, President of the Alumni Association, will introduce the speakers with "appropriate" stories.

Help your officers by early replies. Telephone VICtory 1600 and ask for the "Alumni Office" and make your reservations. If you are out of town write for your reservation. The price of the dinner is $1.75 which includes tip and tax. You are going to get the best dinner you ever had at the Medinah Club of Chicago.



(1) Poles are only one of the hundreds of items which Western Electric supplies.

(2) All materials must pass severe tests. Here an engineer tests a sample of that important little item — rubber tape.

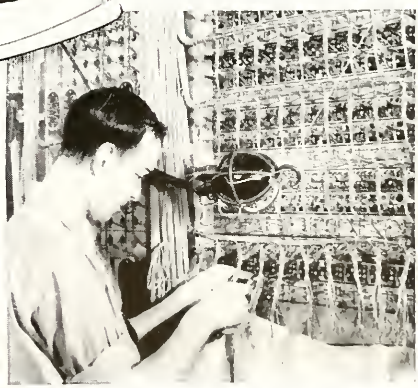
Some things Western Electric does . . . so you can say . . .

"It's good to hear your voice"

(3) Moulding handles for telephone handsets—one of 248 parts in your Bell telephone.

(4) Each of the three thousand, six hundred thirty-six wires in this cable is given a thorough electrical test.

(5) Twenty-nine distributing houses furnish the Bell Telephone companies with practically everything they require.



(6) And the Company installs the equipment in telephone exchanges.

Western Electric

. . . made your BELL TELEPHONE

CANDIDATES FOR ALUMNI TRUSTEE

FRANK E. BARROWS

WORTHINGTON F. PARKER

FRANKLIN M. DE BEERS

Graduated from Armour in 1910.

Assistant examiner, U. S. Patent Office, 1910-11.

Degree of LL.B. from National University Law School in 1911.

Degree of Master of Patent Law from George Washington University in 1912 and from Georgetown University in 1914.

Admitted to the bar in the District of Columbia in 1913, New York State bar in 1918, and the U. S. Supreme Court in 1926.

Practiced patent law in Washington, D. C., 1911-15.

Associated with well-known New York firm of Pennie, Davis, Marvin, and Edmonds, since 1915; and a partner of the firm since 1919.

Member of the Chemists Club, Lawyers Club of New York, Glenridge Country Club, Amer. Bar Assn., New York State Bar Assn., Amer. Patent Law Assn., New York Patent Law Assn., Assn. of the Bar of the City of N. Y., Amer. Chem. Assn., Amer. Electrochem. Soc., Amer. Soc. Adv. of Science.

Trustee of Chemists Club, 1923-32; Secretary of Laymen's Foreign Missions Inquiry, 1930-33; Councilman of Glenridge, N. J., 1930-35; Mayor of Glenridge, N. J., since 1936.

Graduated from Armour in 1905.

Operating department of Commonwealth Edison Co., 1905-07.

Designing engineer in the Chicago branch of the Holtzer Cabot Electric Co., 1907-08.

Designing engineer of the power plant of the Chicago Bell Telephone Co., 1909.

Electrical engineer for the City of Chicago, 1910-11.

Sales engineer for the Electric Appliance Co., Chicago, 1912.

Sales manager, Packard Electric Co. of Warren, Ohio, 1913-15; and general manager, 1915-1927.

President of Standard Transformer Co. of Warren, Ohio, since 1928.

Graduated from Armour in 1905.

Organized the Swenson Evaporator Co. of which he became president and general manager, 1909-1922.

Ch. E. degree from Armour in 1911.

Vice-president and general manager of Whiting Corporation, successors to Swenson Evaporator Co., 1922-24.

In charge of study of surplus crop distribution, with Sun Maid Raisin Co., 1924-26.

M. E. degree from Armour in 1925.

Consulting engineer, 1925-28.

General sales manager, J. P. Devine Mfg. Co., Inc., 1930-31.

Vice-president, sales manager of the Leader Industries, 1931-32.

Organized the firm of F. M. De Beers and Associates in 1933, of which he is the owner.

Consulting chemical engineer and sales representative for manufacturers of chemical process machinery.

Member of A. I. Ch. E., American Chem. Soc., Chemists Club, Chicago Engineers, Skokie Country Club, Chicago Athletic Association.

REPORT ON THE ANNUAL GIFT PROGRAM

A COMPREHENSIVE report on the pledges and contributions to the Annual Gift Program being sponsored by the Alumni Association will be made at the Spring Meeting and Banquet on June 6. The Board of Managers of the Alumni Association, however, want it announced that there will be no soliciting of gifts or pledges at the dinner-meeting.

In the few weeks remaining before the final report, it is hoped that all class representatives and their assistants will make a concerted effort to improve the showing of their respective classes by completing their contact work and re-canvassing all likely prospects. Some classes have responded very well, whereas other classes should enjoy a better rating. Although we are not trying to engender class rivalry, we do believe that the members of those classes who will be reported favorably at the Alumni dinner-meeting will feel proud, while members of the other classes may feel embarrassed.

It would be highly desirable to marshal every graduate of the Institute as a representative of his class in the promotion of our Annual Gift Program, but so large a group would be unwieldy in our organization work. However, we do need the financial support and active salesmanship of every student who has left Armour Institute. We wish that they would all regard this as an invitation to join up as an assistant in their respective classes and consider themselves fully commissioned to rustle up some pledges and contributions for this year's gift to their Alma Mater.

The Chairman wishes to announce the following changes in the official roster of the Committees in charge of An Annual Gift From Every Alumnus. Fred B. Atwood '31, who had been serving as Secretary to the Executive Committee, has been transferred to Philadelphia for an indefinite period, and his duties have been assumed by Clinton E. Stryker '17. The latter's duties as Vice-Chairman in charge of the classes of 1921 to 1926 have been assumed by John P. Sanger '21. Harry C. Eichen has been appointed representative of the class of 1928, and Wesley S. Wieting has been appointed representative of the class of 1936.

LETTERS FROM THE ALUMNI

Left to right: Cronin, Weber, Robinson, Matthews, Merry, Wagner, Niestadt, Taussig.

Rogues of '03

The accompanying photograph depicts eight rogues of '03 finally rounded up to attend our Thirty-Fifth Anniversary held at the Medinah Club last year; this photograph was taken in back of Guey Sam's Chinese Restaurant at 22nd and Wentworth Ave., where all of us enjoyed a tip-top lunch, and spent two hours afterwards listening to some tall tales extending back to the 19th century. Have you ever noticed that the romantic element in historical events varies in direct proportion to their age?

After considerable correspondence and entreaties, coupled with threats, we finally managed to obtain snapshots, photographs, paintings, and landscape views of the following '03 rogues.

H. B. Rawson out in Montana.

Samuel Wendt, Long Island.

John E. Lanning, way down in Morenci, Ariz.

Stanley B. Sherman of Racine, Wis.

Chas. T. Brimson, Coral Gables, Fla.

John Mueller, Cincinnati, O.

Billy Byrne, St. Paul Minn.

John Strickler, Detroit.

Emil Nelson, Pittsburgh.

From the appearance of these decrepit fellows, and what not, it would

ALUMNI DIRECTORY

THE Alumni Directory, authorized by the Board of Control the latter part of 1938, is expected to be ready for distribution the early part of June.

The Directory, as you know, will contain much information concerning your classmates, their activities, location, occupation, and hobbies and considerable information about the Institute.

Those who have not sent in twenty cents to cover the cost of distribution should do so at once if they wish to be assured of a copy.

appear that Father Time has treated these several Armour Men quite kindly, although in most instances the lack of hair is evident. We cannot pass the snapshot of the interior of Rawsen's Montana den, since there are several articles shown therein which make it appear as a cross between a library, a shooting gallery, and a full fledged tavern; in fact the eight men shown above spent most of their time trying to ascertain the label on one of the bottles next to the lamp, and some day we hope to solve this mystery.

At any rate we had a swell time, went all through old A.I.T. with its ramifications of new departments and laboratories located in the Old Armour flats, and then met at the Medinah Club to enjoy a never-to-be-forgotten dinner with music and speeches galore.

It is hard to say when eight men of '03 will get together again, and we hope that as many members as possible will find it convenient and worthwhile to assemble at the Annual 1939 Banquet; but this thirty-fifth Reunion will surely live in our memories as a very memorable date for many, many years to come.

We take this occasion to extend our best wishes to all '03 men, and wish them Health and Happiness for many years to come.

Arthur Wagner, '03.

Dave Smith, '30; Now at Charleston, W. Va.

Dear Sir:

I had a very enjoyable visit from Art Jens, (F.P.E. '31) at Huntington, W. Va., shortly before I moved last month. We talked of several of the fellows at school, and I was interested to hear how well most of them were doing. He told me of most of the developments around the Institute, and it looks as if they may be able to make something of the old place after all.

I have been rather unsettled since the first of the year. I had planned to go back to Lexington, Ky., for the Lumbermen's and had made arrangements to move my family back there when our manager of the Charleston, W. Va., office had a heart attack, permanently disabling him, and they decided I had better cover over here. I came over the 15th of February, and like it fine so far. Living expenses are quite high, being on a big city level, because of the rapid and continued growth of the town. I have met one or two engineers from the du Pont plants, but have run across no Armour men.

I get to Huntington quite often, and my business address there is still 1005-110 Robson-Prichard Bldg.

Best regards, and tell everybody hello for me.

David T. Smith, F.P.E. '30,
709 Myrtle Rd., Charleston, W. Va.

Schreiber, M. E. '25, now president of MacDonald Bros., Inc.

We have received the following announcement:

It is with pleasure that we announce the return of NORMAN B. SCHREIBER to this organization. An associate for ten years and a former vice president of MacDonald Bros., Inc., Mr. Schreiber now returns as president of MacDonald Bros., Inc., of Illinois, management engineers, 310 South Michigan Ave., Chicago.

Bill Chelgren, '38 Enjoys New Job

Dear Editor:

As a correspondent, I am probably not the world's best. This week, I am earnestly attempting to clean up my file of unanswered letters.

This first year in Bridgeport and the East has really gone by in a

hurry; it was just one year ago on April fourteenth that I first set my eyes on this burg when I came here for the interview. The first student report came out at the end of six months, and I was given an "average" rating. Not satisfied with that rating, I immediately buckled down and put forth everything I had in me; as a result, when the second report, covering a three months' period, came out, I received a much better rating. I am now working in the shotshell ammunition plant, having been through the metallic ammunition and cutlery. My notebooks have steadily improved; in fact, my shotshell appears to be so good that the sales department is using it right now to help them in preparing a manual for salesmen. In addition, I have been working on several special jobs, so I am now beginning to feel that the company knows that I am around.

Did you know that Paul Henriksen in this year's class at Armour has been hired as one of this year's students? He applied for a job here, and some of the men at the plant called me in to hear what I had to say about Paul; I did my best for him and am glad that he got the job here.

This winter, I have been doing a lot of skiing. We went up to Pittsfield and Mount Greylock in Massachusetts most of the time. On Easter Sunday, believe it or not, we skiied in forty-two inches of snow at Peru, Vermont which is near Manchester. It was my first visit to Vermont, and it was certainly very beautiful; the sap buckets were on the maple trees, the first time that I had ever seen them. I am hoping to be sent out to our plant at Kings Mills, Ohio at the end of June, which is near Cincinnati.

Just before Christmas, I spent one evening in New York with Paul Martin, E.E.,'37. We had a great time talking over school days and what not.

Since the first of this year, I have become aware of two important points: the first is that an ability to write good reports is of great advantage; second, that engineers are awful speakers before meetings. I have had several opportunities to write reports which happened to be fairly good, I guess; my director stated that so many college graduates are unable to write understandable accounts of their work; I thank my English courses at Armour for giving me a knowledge of report writing. Then about the second point: I have attended many meetings during the past months at which engineers gave lectures on technical subjects, and it was pitiful to see and hear some of them; they seem to forget that people are trying to acquire some knowledge from their talks. I really think that public speaking and class room talks should be more widely stressed.

Here I am already criticizing the world, and I am only a yearling myself, so I'd better stop and tend to my business.

When you find a few moments to spare from your many duties these days, please let me hear from you again, and I shall attempt to be a bit more prompt in replying.

Yours sincerely,

Bill Chelgren, M.E.,'38,
773 Connecticut Avenue, Bridgeport, Conn.

Bob Marshall, '38, Graduate Fellow at U. of W.

Dear Editor:

It has taken me an unduly long time to say hello to you from Madison, but I am happy that you too believe it is "better late than never."

My experiences and work here have been most enjoyable and pleasant. Dr. Hougen is most inspiring to a graduate student, and I certainly feel fortunate in having this opportunity. The experience of campus life is not hard to take, either. Madison is a very pretty city, and the presence of four lakes adds materially, and even spiritually, to the town's attractiveness. I am afraid, however, that spring in Madison is not exactly conducive to hard, grinding work.

I wish to compliment you on the excellent job you are doing on the ENGINEER. I have not seen any college publications which can compare with it. . . . I still think about Armour, and appreciate all it has done for me.

I shall be home for spring vacation.

Very sincerely yours,

W. Robert (Bob) Marshall, Jr., Ch. E. '38,
110 E. Johnson St., Madison, Wis.

Morrison, '35 Is Transferred

Dear Editor:

Early in February I was rather unexpectedly transferred from our main office in Nashville to our branch office at Chattanooga, and expect to be working here for quite some time.

I enjoy the ENGINEER very much and look forward to receiving each issue.

Yours very truly,

John K. Morrison, F.P.E. '35.
Tennessee Inspection Bureau, 919 James Bldg., Chattanooga, Tenn.

ALUMNI NOTES

Most of the changes mentioned in these notes were received too late to be included in the forthcoming Alumni Directory.

Please send in any further changes or news.

1897

JAMES R. SLOAN, E. E., recently had luncheon with his classmate Billy Sims in Chicago. Then Billy returned the compliment by having lunch with Sloan in Pittsburgh. Mr. Sloan is Chief Electrician of the Central Region of the Pennsylvania Railroad, 1009 Pennsylvania Station, Pittsburgh, Pa.

WILLIAM F. SIMS, E. E., 633 Thatcher Ave., River Forest, Ill., spoke at the Thursday luncheon of the Midwest Power Conference on "Reliability of Power Supplies to Metropolitan Systems." He is Chief Electrical Engineer for the Commonwealth Edison Co., 72 W. Adams St., Chicago.

1899

Well, BOYS, you will have the opportunity this spring of celebrating the FORTIETH ANNIVERSARY of your graduation from Armour Institute. Why not make it a real event? Every member of the class should get in touch with ALFRED S. ALSCHULER, Arch., 28 Jackson Blvd., Chicago, Ill.; telephone, HARrison 2582. Let Mr. Alschuler know you are coming.

1903

JOHN E. LANNING, E. E., is with the Phelps Dodge Copper Co. at Morenci, Ariz. He was formerly with their United Verde Branch at Clarkdale, Ariz.

1904

The THIRTY-FIFTH reunion of the class of 1904 will be held Tuesday, June 6, at the Medinah Club of Chicago. We hope you will do everything to make it a success. It will be a real treat to meet your former classmates, some of whom you may not have seen since your graduation. The chairman of the Reunion Committee is JAMES C. PEEBLES, E. E., Professor of Experimental Engineering, Armour Institute of Technology, 3300 Federal St., VICtory 4600; or 9846 S. Hoyne Ave., Chicago, BEVerly 944. Please get in touch with him and let him know your plans.

RAY W. HAMMOND, E. E., formerly residing in Fremont, Nebr., has moved to 933 Ocean Ave., Apt. 3, Santa Monica, Calif.

1905

GEORGE W. FISKE, M. E., Manager of Shell Oil Refinery, Signal Hill, Long Beach, Calif., has moved to 3911 S. Normandie, Los Angeles, Calif.

1906

THOMAS EDW. LYNCH, Ex. C. E., has become a life member of the Alumni Association. He is in the Water Pipe Extension Division of the City of Chicago, 7421 South Western Ave.

FRANKLIN A. WANNER, M. E., formerly of Kenilworth, Ill., resides at 1533 Chase Ave., Chicago. He is a realtor at 19 S. LaSalle St., Chicago.

1909

On June 6 will be the celebration of the THIRTIETH ANNIVERSARY of the graduates of this class. We hope that 1909 will be well represented. Be sure to let FRANK C. VAN ETTEN, E. E., 2146 West 110th St., Chicago, BEVerly 7271, know your plans for Tuesday evening, the 6th. Mr. Van Etten is in the Advertising Dept. of Delta-Star Electric Co., 2400 Fulton St., Chicago, SEEley 3200.

ELWOOD MILLEN PINKERTON, E. E., manager of the General Electric Company, 107 South 5th St., Minneapolis, Minn., has become a life member of the Alumni Association.

1910

RICHARD A. LEAVELL, M. E., is with Associated Counsellors, 972 Penobscot Bldg., Detroit, Mich.

1913

PAUL V. FRARY, F. P. E., salesman with Penn Mutual Life Insurance Co., 50 Church St., New York City, has recently moved to 13 Orchard Rd., Great Neck, L. I., N. Y.

1914

The TWENTY-FIFTH ANNIVERSARY of your class will be celebrated this spring on the first Tuesday in June. Keep the afternoon and

evening of the 6th open for the annual spring alumni banquet and reunion which will be held at 505 N. Michigan Blvd., Medinah Club of Chicago. Please let LOUIS HIRSH (Ch. E.), with Security Life Ins. Co. of America, 134 N. LaSalle St., Chicago, RANdolph 0867 know you are coming. His home address and telephone number are 6341 N. Claremont Ave., HOLlycourt 2928.

EMIL J. HEPP, F. P. E., was recently promoted from Superintendent of the Improved Risk Dept. to Assistant Secretary in the Western Dept. of the Springfield Group of Fire Insurance Companies, 222 W. Adams St., Chicago, Ill.

HERBERT E. JEDDY, C. E., formerly of East Cleveland, Ohio, resides at 160 Lincoln Ave., Lexington, Ky.

1915

EUGENE S. HARMAN, M. E., left Gary, Ind., and is now living in Chicago, Ill., 5541 Everett Ave.

EDWARD T. TAYLOR, Indus. Arts, has moved to Route 1, Box 195, Dade City, Fla. He formerly taught at Lane Technical High School, Chicago.

WALTER L. BORROUGHS, E. E., 1707 Hillshire Drive, Kalamazoo, Mich., has become president of the Probor Products Co., 345 E. Kalamazoo Ave., same city.

1916

CHESTER F. WRIGHT, E. E., residing at 6th Ave. Extension, Lake Worth, Fla., has been elected President of the Florida State Board of Engineering Examiners. Wright formerly was Vice President.

1917

GERALD T. DOUGHERTY, Ex. Ch. E., who was with the Standard Oil Co. of Indiana at Springfield, Mo., is now living at 6852 Crandon Ave., 2nd Apt., Chicago.

RICHARD B. KURZON, Arch., whose architectural offices are at 134 N. LaSalle St., Chicago, has changed his residence to 727 Forest Ave., Evanston, Ill.

1919

The TWENTIETH REUNION of the class of 1919 will be held at the Medinah Athletic Club, 505 N. Michigan Blvd., Chicago, the evening of June 6, so kindly make your plans accordingly. ERLING H. LUNDE, M. E., Sales Engineer, Central Tools, Inc., 80 East Jackson Blvd., Chicago, WABash 7586, is Chairman of the Reunion Committee. Mr. Lunde's residence is 6708 N. Olympia Ave., Chicago; NEWcastle 1104. He would like to hear from every one of you.

1920

HAROLD D. STEVERS, E. E., has been transferred from Nashville, Tenn., to Little Rock, Ark., U. S. Engineer Office. Home address, 1315 Kavanaugh Blvd., same city.

1922

WILLIAM J. CHAPIN, M. E., 3047 S. Superior St., Milwaukee, is completing arrangements for the Annual Golf Tournament of the Wisconsin Armour Alumni at Eagle Lake Country Club, Eagle Lake, Wis. Write Charles M. Schneider, F. P. E. '27, Fire Insurance Rating Bureau, 626 East Wisconsin Ave., Milwaukee, Wis., for details.

FRANK J. BURSIK, M. E., formerly living in Los Angeles, Calif., now resides at 197 N. Long Common, Riverside, Ill.

BENJAMIN F. MORRISON, C. E., Attorney at Law, with offices at 111 West Monroe St., Chicago, is a candidate on Republican ticket for Judge of the Circuit Court. After graduation Ben went to work in the Chicago Board of Local Improvements where he advanced to the position of engineer of contracts and specifications. While working at the Board of Local Improvements, he attended Chicago Law School, securing his law degree after three years of study. In 1932 he opened his own law office and has continued to practice ever since. Those in the alumni who know Morrison intimately consider him eminently well qualified for the office which he seeks.

1923

HAROLD G. LOVE, E. E., has changed his place of residence to 125 Dupee Place, Wilmette, Ill. He is engineer with Weiss and Niestadt, 343 S. Dearborn St., Chicago.

1924

CLASS REUNION

The class of '24 is arranging a get-together to celebrate the FIFTEENTH ANNIVERSARY of their graduation from Armour Institute. This will be held on June 6 and is to be an all day affair, consisting of a visit to the Institute in the morning, luncheon followed by golf or cards in the afternoon at the Medinah Country Club, and attendance at the Alumni Spring Banquet at the Medinah Athletic Club in the evening. Transportation for those from out of town and others not having facilities, will be provided for getting to the Country Club, and from there to the Medinah Athletic Club downtown for the banquet.

Letters are being mailed to all those shown on the Institute's records as being of the class of '24, and a large turnout is expected. However, if there are any who were members of this class and failed to receive their letters, please get in touch with the chairman of the Reunion Committee, J. STANLEY FARRELL, E. E., 10244 S. Leavitt St., Chicago; telephone BEVerly 10244; and tell him you will attend.

LET'S TRY AND MAKE THIS REUNION A 100% AFFAIR.

KALMAN STEINER, Ch. E., has returned as President of the Ace Engineering Co., 4725 West 31st St., Chicago, Ill. He received word from ALBERT SCHRIEBER, B. S., M. E. '38, on whom comments are made under that class.

EUGENE J. TERRY, F. P. E., won high honors with an average of 186 at the Milwaukee Alumni bowling party on April 21. "Zeb" is with the Fire Insurance Rating Bureau in Milwaukee, 626 East Wisconsin Ave.

RICHARD R. RANSON, E. E., Electrical Engineer for Cutler-Hammer Co., 4816 N. Larkin St., Milwaukee, Wis., will conduct the business session of the A. I. E. E. election meeting of that city in May. Dr. Poulter is to be principal speaker.

EARL R. SANBORN, F. P. E., was recently called into the Chicago office of the Great American Fleet as Superintendent of the Improved Risk Dept. He was State Agent for one of their companies in Wisconsin prior to his promotion. Sanborn lives at 243 Webb St., Hammond, Ind.

1925

RALPH O. BUCK, Indus. Arts, residing at 6917 Olcott Ave., Chicago, has been for many years associated with *Popular Mechanics* magazine as a designer of home work projects. Some of the excellent drawings may be seen in recent issues of

that magazine. He is instructor in mechanical drawing at Lane Technical High School.

1926

DOUGLAS R. STIEHL, M. E., District Sales Manager for the B. F. Sturtevant Co., has been transferred to Los Angeles, Calif., 817 Hollingsworth Bldg. Home address, 901 S. Irolo St., Los Angeles.

1927

CHARLES M. SCHNEIDER, F. P. E., Engineer with the Fire Insurance Rating Bureau, 626 E. Wisconsin Ave., Milwaukee, is president of the Milwaukee Armour Alumni Association. Residence, 1444 N. Astor St., same city.

ROBERT Y. GOO, Arch., 2317 Wentworth Ave., Chicago, Ill., is a practicing architect at 360 N. Michigan Ave.

CHESTER LONG, F. P. E., has changed his residence to 1311 W. Palm Lane, Phoenix, Ariz. Mr. Long is Special Agent for Arizona for the Glens Falls Insurance Co. He was formerly located in Denver, Colo.

1928

RICHARD H. BATES, C. E., is now living at 919 Plainfield Rd., Joliet, Ill.

LeROY J. ERICSSON, E. E., has moved from St. Louis, Mo., to 16 Greendale Drive, Normandy, Mo.

HARRY L. KRIEGER, F. P. E., has changed his home address to 945 Franklin Ave., Columbus, Ohio. He is still with the Ohio Inspection Bureau.

KENT L. MACY, F. P. E., 5805 Forest Lane, Indianapolis, Ind., has been promoted to Special Agent operating out of that city for the America Fore Insurance and Indemnity Group.

WILLYS E. THOMAS, M. E., formerly of Webster Groves, Mo., resides at 116 S. Grove Ave., Oak Park, Ill.

EVERETT E. GRAMER, E. E., vice president of the Standard Transformer Corp., 1500 N. Halsted St., Chicago, Ill., lives at 6652 N. Chicora Ave.

1929

The TENTH REUNION for this class will be held the evening of June 6 at the Medinah Club of Chicago, 505 N. Michigan Blvd. It is a grand place to make a real event of the annual spring banquet of the Armour Alumni Association. Kindly cooperate by letting Mr. RAYMOND F. STELLAR, C. E., know what your plans are. Mr. Stellar's residence is 6732 Oglesby Ave., Chicago, MIDway 1733. He is in the United States Engineer Office, 932 U. S. Post Office Bldg., Chicago, WABash 9207, local 339. He will be glad to hear from all of you.

CARL A. BLOMQUIST, M. E., was instantly killed in an automobile accident January 9 while on his way with Mrs. Blomquist from St. Louis, Mo., to choose a new home in Nashville, Tenn., where he was to have been transferred by the Link Belt Co. He had been connected with that company for almost ten years. Our sincere sympathy is extended to his widow, who now lives at 1730 Foster Ave., Chicago, Ill.

SEYMOUR F. GOODHEART, Ch. E., has been transferred from Philadelphia, Pa., to Monmouth Junction, N. J., by the Frederick H. Levy Co. Home address, Stout's Lane, Monmouth Junction, N. J.

FRED W. McCLOSKA, E. E., has changed his residence to 8222 Oglesby Ave., Chicago, Ill. He is testing engineer for the Chicago District Electric Generating Corp., Hammond, Ind.; also instructor in A. C. Machinery at Armour Institute.

1930

HIRAM W. MONTGOMERY, F. P. E., 1521 Sherwin Ave., Chicago, joined the engineering staff of the America Fore Fire Insurance Companies, 844 Rush St., same city. The past several years were spent with the Federal Hardware and Implement Mutuals, working in Northern Illinois.

JOSEPH R. LOSSMAN, F. P. E., formerly special agent and engineer for Pearl Fleet in Cleveland, has been transferred to Columbus, Ohio, Ohio State Saving Bldg., where he will serve as state agent.

ROBERT B. JOHNSTON, M. E., salesman for the Armstrong Cork Products Co. of Detroit is working out of that city instead of their Chicago office. His home address is 2170 East Jefferson Ave., Detroit, Mich.

WILLIAM K. SIMPSON, Ch. E., now resides at 400 N. Dover, LaGrange, Ill. He is Chemical Engineer in the Treating Research Divi-

sion of the Universal Oil Products Co. of Riverside, Ill.

1931

CHARLES T. LINK, JR., M. E., was married on February 18 to the former Miss Lois Dorothy Lange of Chicago. Vern Peterson, E. E. '29, Chuck Jens, F. P. E. '32, and Art Jens, F. P. E. '31, acted as officials at the wedding. After a honeymoon spent at Hot Springs, Ark., the Links reside at 3219 Balmoral Ave., Chicago, Ill. Charlie is development engineer for the White Cap Co., 1812 N. Central Ave. Congratulations and a happy union!

THEODORE J. JANKOWSKI, Ex. C. E., 4742 Schubert Ave., Chicago, is in the Construction Dept., Subways and Traction Commission of the City of Chicago, 27 West Chicago Ave.

WALTER M. MIRAN, F. P. E., was transferred from the Chicago office of the Insurance Co. of North America to act in the capacity of District Engineer, working Nebraska, Iowa, and Kansas, from 1910 Harney St., Omaha, Nebr. Residence, Apt. 122, 836 Park Ave., Omaha.

CARL E. KREIBICH, E. E., has moved to 5526 Agatite Ave., Chicago, Ill. He is with the Illinois Bell Telephone Co., Plant Dept., 311 W. Washington St.

EVERT W. SHOAN, Arch., agent and broker for Travelers Ins. Co., Oak Park, Ill., lives at 133 Linden Ave., same city.

ALBERT F. WILDE, F. P. E., is now in St. Louis, Mo., 1107 Louisville Ave.

EDWARD J. LOPATOWSKI, C. E., reported among the missing has been found. He is junior civil engineer in the War Dept., U. S. Lake Survey, 649 Federal Bldg., Detroit, Mich. His Chicago address is 1523 Thomas St.

1932

Word has been received that WALTER C. BREH, E. E., has moved to 248 N. Foley Ave., Freeport, Ill.

ARTHUR R. VIEL, Ch. E., Directing Research for the Stimson Reflector Co., 412 N. Leavitt St., Chicago, resides at 303½ N. Central Park Ave., same city.

DAN WHITE, M. E., lives in Wichita, Kansas, 1121 Forest Ave. He was formerly connected with the Electro-Motive Corp., LaGrange, Ill.

GLEN W. SCHODDE, F. P. E., Examiner for Hardware Mutual Insurance Co. of Minnesota, 2344 Nicollet Ave., Minneapolis, has changed his residence to 4124 Raleigh Ave., St. Louis Park, Minneapolis, Minn.

EDMUND FIELD, Ch. E., has moved to 307 West 18th St., Wilmington, Del. He is chemist for Du Pont de Nemours and Co., Ammonia Dept., Experimental Station, same city.

1933

GEORGE E. HANRAHAN, C. E., has changed his residence from Oak Park, Ill., to 506 Hampton Place, Portsmouth, Virginia.

LEROY F. SKUBIC, Arch., formerly of Blue Island, Ill., now resides at 5655 S. Richmond St., Chicago, Ill.

JOSEPH J. GURA, F. P. E., 58 Charles St., Auburndale, Mass., is now with the Federal Hardware and Implement Mutuals, working out of Boston.

WILBUR E. BAUMANN, C. E., moved from Ada, Okla. to Byars, Okla.

K. LEWIS HACKLEY, Ch. E., with R. R. Donnelley and Sons Co., is now living at 615 Shakespeare Ave., Chicago, Ill.

1934

Be sure to reserve Tuesday evening, June 6, for the annual spring banquet which will be held at the Medinah Club of Chicago. This will be the FIFTH ANNIVERSARY for this class. We shall be glad to help in any way we can to make this a big reunion. HAROLD W. A. DAVIDSON, C. E., is chairman and would like to hear from you as to your plans for that evening. Residence, 2027 Farragut Ave., Chicago; telephone, RAVenswood 8695. Mr. Davidson is Sales Engineer for Joseph T. Ryerson & Sons, Inc., 16th and Rockwell Sts., Chicago. LAWndale 1000.

GERALD E. MYERS, F. P. E., Naperville, Ill., has left the Illinois Inspection Bureau to join the Engineering Dept. of W. A. Alexander & Co., 135 S. LaSalle St., Chicago.

LEONARD MARCUS, C. E., visited Armour Institute the early part of March, on his way to Portsmouth, Virginia, where he is employed in the Norfolk Navy Yard.

HARRY M. FLYER, Arch., is designer for Midland Development Co., 176 W. Adams St., Chicago. Residence, 1626 S. Hamlin Ave., same city.

FRANCIS M. GIBIAN, M. E., has removed from Santa Monica, Calif., to R. D. No. 3, Dundalk, Md.

FREDERICK C. W. NOERENBERG, Ch. E., is Junior Industrial Engineer for Hansen Glove Corp., 539 W. Wright St., Milwaukee, Wis. His Chicago address is 6203 S. Carpenter St.

1935

JOHN L. ROBERTS, F. P. E., 1118 S. Austin Blvd., Oak Park, recently resigned as Inspector with the Fire Insurance Rating Bureau of Wisconsin to become district selling representative for Scott Paper Co., 435 N. Michigan Ave., Chicago.

GEORGE A. NELSON, C. E., was married to the former Miss Elizabeth Phelan on April 12. Best of luck! Nelson is assistant chief of the Hydraulic Research Center, U. S. Waterway Experimental Station, Vicksburg, Miss.

ELLIS H. DOANE, JR., F. P. E., is with the Western Sprinkled Risk Assn., 1313 W. 112th St., Cleveland, Ohio. Residence, 11825 Lake Ave., Lakewood, Ohio.

CHARLES HANDLER, E. E., has left Altavista, Va., and is now residing at 1222 Hood Ave., Chicago, Ill.

JOHN S. WALKER, Ex. E. E., Payroll and Cost Clerk for the Public Service Co. of Northern Ind., Hammond, Ind., lives at 308 Schrum Rd., South Holland, Ill.

ALEXANDER KULPAK, M. E., gave a recital of operatic, classic, and folk songs, on March 5 at the Women's Club Theatre, Chicago. His residence address is 541 N. Harvey Ave., Oak Park, Ill.

1936

ALBERT HENRY MAACK, Ch. E., returned, as metallurgist, to his

former employer, the Wisconsin Steel Works, 2701 East 106 St., Chicago, Ill.

NEWTON WM SNASHALL, M. E., Industrial Engineer for Armour and Co., Union Stock Yards, Chicago, now resides at 710 West 76th St., Chicago.

1937

Our heartfelt sympathies are extended to the family of LAWRENCE RICK, Ch. E., who passed away on the 7th of April, on account of pneumonia.

KENNETH F. CARROLL, M. E., Assistant Chemist for the Prest-O-Lite Co., Inc., Speedway, Ind., resides at 1652 Georgetown Rd., Indianapolis.

BERTIL W. JOHNSON, E. E., is with the Gary Heat, Light, and Water Co., 504 Broadway, Gary, Ind.

1938

DAVID B. RODKIN, M. E., and ALBERT N. SCHRIEBER, M. E., have taken an apartment together at 1008 Burwell St., Bremerton, Wash. They are civilian engineers, stationed at Puget Sound Navy Yard in that city, working part time and training part time.

EDMUND A. BROWN, E. E., is Junior Engineer in the Test Course of General Electric Co., Schenectady, N. Y. Residence, 1802 Hamburg St., same city.

GAN B. ENG, Ch. E., 336 Arch St., Lawrenceburg, Ind., is with Joseph E. Seagram & Sons, Inc., of that city.

PROGRESS IN LIGHTING

(From page 12)

must be used every minute to keep it cool. These 1,000-watt water cooled mercury lamps will produce a light that is one-fifth the brightness of the sun. The New York Fair will mark their first commercial application.

The fourth lighting project on Constitution Mall is the Federal Building. A series of floodlights will throw light of a new golden color on the spires and towers of this building.

In addition to these spectacles of exterior illumination, many new effects have been devised for lighting Fair building interiors. More than 2,500 specially designed flush-ceiling fixtures have been manufactured in the Westinghouse Cleveland Works under patents obtained by the Fair management. Under this patent, present use is confined to the Fair and exhibitors, but these fixtures should soon be available for public use.

Another new lamp that will provide spectacular illumination for both interiors and exteriors of Fair buildings is the new low-voltage fluorescent lamp of tubular type. These new lamps produce colored light efficiently and economically, and occupy small space.

Thus, we see that at another of these great World's Fairs, applied lighting engineers have met the challenge in providing the lighting of the future for the world of today. Visitors to the New York Fair should return to their homes with the realization that lighting and illumination are keeping ahead of the needs of the American public.

 (From page 30)

Armour Eye, does exceptionally fine photographic work; the rifle club maintains a competent team. All of these activities are maintained, supervised and managed by the Armour Tech Student Association, an organization of all students, and financed in the main by an activity fee.

Student publications include the ARMOUR TECH NEWS, a weekly newspaper, and the yearbook (THE CYCLE). There are active and flourishing student branches of the American Institute of Architects, American Institute of Chemical Engineers, American Society of Civil Engineers, American Institute of Electrical Engineers, American Society of Mechanical Engineers, Western Society of Engineers, Society for the Advancement of Management, and a Fire Protection Engineering Society. Various departmental honor fraternities maintain chapters, and there is a long established and strong chapter of the general engineering honor fraternity, Tau Beta Pi.

The Student Union, except for restaurant, book store and coat room, is operated by a student board, which employs a full-time manager.

The Academic Program

This is not the place to describe the academic program. The Institute's General Information Bulletin deals with it exhaustively. The Armour student, whether Architect or Engineer, finds in the academic program the basic requirements of a sound general education for life in a complex world, as well as in the fundamental sciences, upon which his training for entrance into his professional field is based.

Throughout the student's career at Armour, he has available to him the services of the Student Personnel Department which, under the general administration of the dean of the Undergraduate College, guides and aids him upon his way by educational tests and measurements, and by academic, general, vocational, and special counselling, all looking to the development of social competence and character, accompanying the mental training provided by the curricula.

Traditionally, the strength of Armour has been in the men of its staff. The loyalty of its Alumni has been founded not upon ivy-covered walls, stately elms or a victorious football team, but upon ideas and ideals exemplified by personalities. This has resulted from sound and thorough undergraduate teaching, a deep personal interest in students as individuals on the part of staff members, and unusually close student-faculty relationships. This tradition must, and will, be maintained in spite of the increase of the undergraduate body to nearly 1200, and of the faculty to over 100.

The above pertains primarily to the Undergraduate College. The story of the Evening Division, and of the Graduate Division, will be told in future issues.

FROM SICKLE TO COMBINE (From page 9)

Some one-man combines are now being offered with even smaller cuts.

This latest descendant of the reaper handles more than wheat. It harvests and threshes grains and all threshable seed crops. The list of them would contain 100 or more items.

The fruits of Cyrus H. McCormick's invention show most clearly when measured by the yardstick of human toil. In 1830 the harvesting of an acre of wheat, from its cutting with a cradle to its sacking, required 37 hours. Ten years later McCormick's reaper had cut this time to $11\frac{1}{2}$ hours. In 1896 the binder and improved threshing methods had reduced the time to three hours per acre. Today the 6-foot combine and the tractor will cut and thresh an acre of wheat in a half-hour.

In the last analysis, of course, the worth of any invention must be measured by its contribution to the lives of the people who use it. In this social sense the contribution of the reaper and its mechanical descendants has been incalculable. Without these farm machines our present industrial civilization clearly would have been impossible. We could not have released from toil on the farms the men needed to man the machines of industry or the agencies of distribution. If we had tried, we could not have fed them.

This movement of people from farms to cities was, until a decade ago, one of the more conspicuous features of American social change. Since 1930, however, there has been evidence of another tendency.

A study published by the United States Department of Agriculture in 1937 showed that between 1930 and 1935 the total number of farm workers in the United States increased from 10,482,000 to 12,408,000. About 2,000,000 of the persons living on farms on Jan. 1, 1935, had not been farm residents five years before.

Equally interesting was the disclosure that in the same five-year period the total number of American farms increased by one-twelfth and that the majority of the 500,000 new farms thus established were near large industrial cities.

I do not believe it is a mere coincidence that this trend manifests itself at a time when new developments in farm equipment constantly increase the productivity of farm labor, lighten the toil, and enrich the leisure of those who till the soil.

 (From page 21)

rails, for example, are apt to give indications on the tape with the consequent daubs of paint on the rail, and the operator must quickly determine whether such marks are due to the burn or some other cause. This, of course, he does by carefully viewing the receding rails from his window in the rear of the car, making every effort possible to differentiate between the indications on the tape and the surface conditions of the rail. Necessarily he occasionally makes a mistake, and as the human equation thus frequently enters into testing, it is relatively important that anything that can be done to reduce the chance for error will be of great benefit. Constant studies along these lines are being made, and some highly satisfactory results have already been obtained. Future improvement of Detector Cars will manifestly be in this particular direction, while also hopefully some method will be found for testing in the angle bar zone, and through other places such as frogs, switches, and crossings where distortions of the field are equally troublesome. Thus we all recognize certain frailties of Detector Cars but are nevertheless thankful that the general principle followed and the improvements made in ten years' time have been so advantageous in the direction of making railroad transportation safe.

Save the Date ....

TUESDAY, JUNE 6, 1939, 6:30 P. M.

ANNUAL ALUMNI BANQUET

MEDINAH ATHLETIC CLUB, AS USUAL

 (From page 15)

Mojonnier test, which is an ether-extraction process. Bacteria counts are regularly made on raw materials as well as on the finished ice cream.

The transportation of ice cream to the retailer is another problem peculiar to the industry. Ice cream must be delivered quickly and kept at a constant temperature from the time of production to the time of actual consumption. If the ice cream melts and later is again frozen, it loses its flavor and texture. Several years ago, cans of ice cream were originally packed in salt and ice and when delivered, the dealer again had them packed in salt and ice in a container in his place of business. This necessitated the carrying of large weights of ice and salt by the trucks and many other inconveniences resulted from the use of this refrigerant. To overcome the disadvantages of the ice pack, the company developed a system which has revolutionized refrigeration transportation. They have 2½ ton Dodge trucks with bodies capable of carrying from 550 to 620 gallons of ice cream, depending upon the type of containers stored in the truck. These bodies are insulated with six inches of corkboard and have ammonia coils built into them with outside connections for hook-up to the plant refrigerating system. The trucks are loaded as they return from their routes in the afternoon. They are then connected to the central refrigerating system immediately after being parked in their respective stalls in the garage. During the night, the truck temperature is pulled down to minus 20° to minus 30° F. and in the morning, the ammonia is pumped out of the coils as much as possible. On the hottest of summer days, with the truck having a traveling range of from 50 to 80 miles, the temperatures in the various compartments never go above 50° F.

Time and space permitting, much could be said about the mechanically refrigerated soda fountains and ice cream holding cabinets which have now for several years replaced the old type ice and salt method of storing ice cream in customer outlets. Suffice it to say, that mechanical refrigeration has completely revolutionized the ice cream industry. It has done much to permit manufacturers who previously had de-centralized their operations because of the heavy loads of ice and salt which they necessarily had to carry over long distances, now to concentrate their manufacturing and distribution at central points.

Chicago uses about seven million gallons of ice cream annually and is served by some thirty manufacturers, who, by the application of engineering principles, are changing ice cream from the realm of a luxury food to that of a staple food product. When you eat your next portion of ice cream—a soda, a sundae, an ice cream bar, or any other of the innumerable fancy shapes and flavors of ice cream—remember that it is the engineer who has done much to make your enjoyment possible.

THE STUDENT IN PRESENT SOCIETY (From page 23)

foster all possible respect, sympathy, and love for the home. The most efficacious motto is that of mutual participation. This becomes the basis of an active struggle for a new mode of life. The ego no longer predominates.

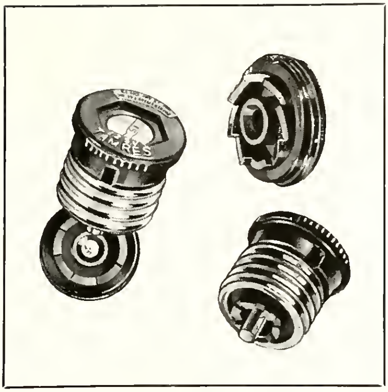
The attitude toward schools and intellectual training likewise underwent some changes. The young students no longer accepted the old way of pure rationalistic thinking and acting; they looked for the irrational powers of the soul, they tried to penetrate into the depths of man's inner world. The field of discussion was removed outside the lecture halls; emphasis was laid on the various problems of life and on a modernization of learned activity. The mode of living became simpler. Some refrained from drinking and smoking, and abolished class presumption; the father's social and professional position was a matter of no importance. In the eyes of the young people, fraternities lost their right to exist. This led recently to their complete abolishment, for instance in Germany. There are not a few voices in our own country who advocate the very same thing. All this is paralleled by the loss of the high social position which students formerly enjoyed in society, since there was little difference in the ideas and ideals held by students and non-students. Schools, colleges, and universities, as represented by men of the older generation, took little notice of this "juvenile" struggle which, through the non-acceptance of fatherly advice, they thought, resulted in scepticism and endless projections. They considered this kind of self-organized youth as a romantic foreign substance within the traditional social structure. They smiled indulgently and voiced now and then their indignation. They, no more than the middle classes, could quite understand why these young people were no longer fond of drinking bumpers of tasty beer.

Then came the post-war years with an endless series of political, social, and economic crises. The members of the so-called lower society claimed more than ever what had been withheld from them, namely social and professional advancement. They rushed to the schools in order to prepare themselves for the vicissitudes they were going to face in a life which had become increasingly problematic and unsteady. Provided with but small financial means they worked and studied most energetically; parents, no less, lived and still live under the most heroic privations and renounce numerous pleasures in order to make possible the continuation of their children's studies. The harassing feeling that both parents and children might belong to an economically declining class and might in-

tensify proletarianization, paralyzes us, and we give way to resentment. What will become of us, since there are so many who strive for the same goals? In this struggle for existence and self-preservation it is only too natural that there should appear radicalism and, above all, irritation which suspects everyone to be a rival or an irreconcilable enemy.

The way in which student youth reacts is naturally far from uniform. Some still cling to tradition, perhaps overemphasize it. Yet our epoch should not lose confidence in the inspiring power of history and should acknowledge that much simple wisdom and vital strength is embodied in old traditional forms of life. Then, there are the groups which feel themselves members of a working class. These students, provided they combine their work with a thirst for knowledge, represent in fact the nation's future hope; they are very industrious, admirably unpretentious, and demand little; many of them, in fact, take poverty for granted and have learned how to face the vicissitudes of life. I venture to assert that, in spite of all radicalism, scepticism, and disbelief, our modern youth is essentially good; for hardly ever was a generation born into a world so complex and filled with so many signs of despair as ours, hardly ever has youth displayed such heroism in facing and accepting the situation of a rapidly changing world and of an uncertain future. The third group emphasizes, or overemphasizes, sport. Those people enjoy healthy bodies and frequently yield to a mania for beating records. Such students, provided they overstress sport, have shifted their activity to places where it does not belong, for very rarely is prominence in athletics combined with outstanding intellectual accomplishments. Yet sport, the favorite topic in public life, has the advantage of diverting one from politics. A considerable number of students seek the only salvation in politics, not in that kind of politics which may be defined as statesmanship, but in that which comprises party warfare and teaches, in the end, nothing but hatred. These men obtain all their instruction from the assembly halls, speakers, and pamphlets of their respective parties. Cultural values, reason, and tolerance are branded as liberalistic and done away with, and therewith also the best tradition of higher schools. From a human point of view much of this radicalism is readily comprehensible, for the threatening situation in which too many find themselves results in an uncompromising fighting attitude. That this kind of radicalism, blind faith, and surrender to an undiscriminating doctrinarianism is no academic virtue, should be self-evident. No one should think that training of the mind and of personal judgment are of secondary or of no importance.

What is to be done, and what in particular, is the student's position nowadays? In our age of overspecialization no one can be expected to



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have a detailed knowledge of every thing. Since the latter is impossible, we should at least gain an appreciation of the various meaningful branches of human activity (it is clear that "beauty culture," "tap dancing," and the like, do not belong to these). Life and civilization are extremely complex: the individual should be convinced of the necessity which natural sciences, technics, art and literature, law, medicine, etc. etc. have for the welfare and the reputation of a nation and the world and should cease contending with and rivalling the various professions.

Of still higher importance is something that seems gradually to be losing ground all over the world: I refer to personal responsibility. At the beginning of our century youth was very conscious of this virtue and owed much of its strength to this very factor. At first sight it appears so very easy to free oneself from the shackles of individual responsibility and to let others do the thinking. Man deems it to be the easier part, in respect both to comfort and to conscience, to lose himself in the mass and let the mass take the blame for everything for which the individual should be held responsible. Nowadays all sorts of crimes are popularly supposed to have their ultimate causes not in the lawbreaker, but in the nature of modern society, in milieu, Freudian complexes, and what not. From the earliest times man has endeavored to make everything and everyone responsible for his own mistakes and failures and has searched eagerly for a scape-goat in order to increase his feeling of "personal security." Adam, by putting the blame for his transgression on Eve, simultaneously made himself the originator of an idea which is now more in fashion than ever before. The authoritarian state is just another variation of a notion which frees man from the burden of individual responsibility; many people in the various groups are undoubtedly glad to see a small minority relieve them of "fatiguing" and "irksome charges."

An intelligent man who has learned to use his judgment should hold himself aloof from such currents. If higher education in the world is still to mean not the teaching and acquisition of mechanical professional tricks, but the training and the development of clear thinking and simultaneously the intelligent use of reason and of independent discrimination, then the student, conscious of his individual responsibility, will fulfill the mission in society for which an ancient tradition has destined him. Institutions of higher learning have from oldest times been one-sided to some extent; they have been available to relatively few. Yet these few intellectual leaders, and this is the very important factor, must use their capacities for the benefit of all. Intellectual work, as every kind of work, is not meant to proceed in a sphere of "splendid isolation," is not restricted to inaccessible catacombs, but must be performed for the promotion of civilization and for the people and the nation as a whole.

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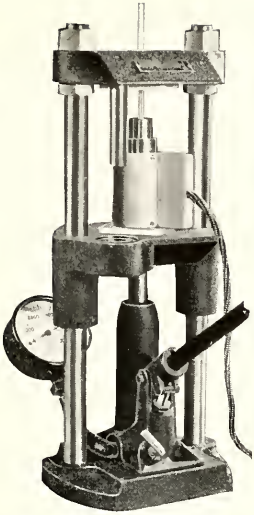

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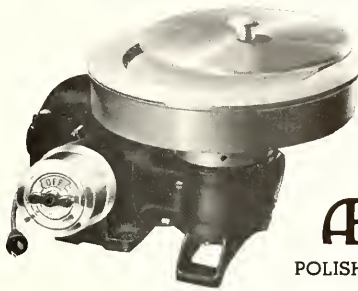

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